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MARSH MANAGEMENT PLAN
MONITORING REPORT

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TENNECO MITIGATION BANK PROJECT

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Natural Resources

Natural Resources

of
Dept
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Louisiana

Final Report

Submitted To:

Department of Natural Resources

Coastal Management Division

P.O. Box 94396

Baton Rouge, Louisiana

Submitted By:

USDA Soil Conservation Service

Alexandria, Louisiana

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INTRODUCTION

The Tenneco LaTerre Corporation (TLT) and the Soil Conservation Service (SCS) have jointly developed a marsh management program which will effect about 5,000 acres of TLT property and 2,014 acres of adjacent property located in Terrebonne Parish, Louisiana. Like many other coastal marsh areas in South Louisiana, this marsh is deteriorating rapidly. The construction of navigation and oil exploration canals, natural subsidence and hurricanes have resulted in fresh marsh converting into brackish marsh and open water.

The management program was designed to stop this trend by increasing freshwater and sediment inflow, improving water circulation, stabilizing water levels, and reducing saltwater intrusion into the management area. This should reduce the rate of marsh erosion and enhance this area. (Soileau, 1984)

If successful, this program will produce fish and wildlife habitat benefits which could be used by TLT as mitigation for unavoidable fish and wildlife impacts associated with mineral exploration activities requiring Corps of Engineers Section 10/404 and Louisiana Coastal Use Permits. (Soileau, 1984)

The Coastal Management Division (CMD) reviews and makes recommendations concerning many Coastal Use Permit applications for marsh management applications each year. It is important that these management plans are consistent with the policies and guidelines of the Louisiana Coastal Resources Program (LCRP) before permit issuance and that they remain consistent after plan implementation. It is CMD's policy that these plans be monitored adequately to evaluate whether the goals are being achieved by implementation of the plan. Monitoring is also needed to indicate whether plan modifications are necessary in order that it may be more consistent with LCRP guidelines.

In order to evaluate the effectiveness of the plan, monitoring should include the gathering and assimilation of information concerning water quality, vegetative change analysis, aerial photography, hunting and trapping records, hydrology, erosion control, fish and wildlife production, and overall primary and secondary production changes.

This report concentrates on the assimilation and summarization of data concerning water salinity, vegetative community characteristics, water level data, and a historical change assessment of the land/water ratio.

MATERIALS AND METHODS

Salinity data has been collected by TLT on a periodic basis from 11/11/85 - 11/26/86. Readings have been taken both inside and outside of the management area at three weir sites and at seven other locations within the management area. Salinity readings were

taken at 12 locations and expressed as parts per thousand (ppt). Yellow Springs Instruments (YSI) were used for the determinations. Salinities were also taken when 22 of these sites were reevaluated in 1986.

Salinity data is presented both in tabular form and with a linear graph for each sample site. Average salinities for each site are also displayed.

Plant species composition was evaluated at the 29 HEP sites in 1982. An ocular estimate (in percent) of each species in the plant community was recorded for each site. When 22 of the sites were reevaluated in 1986, ocular estimates were again taken.

It was the consensus of the HEP team that a more reliable and scientific approach should be implemented to monitor vegetative changes. In November, 1986, 50 meter transects were established at each of the 22 sites. Fiberglass poles were placed at both ends of each transect so that the vegetation can be monitored at exactly the same point periodically. Vegetative species were identified at 5 meter intervals along the transect line and recorded.

Tables comparing the 1982 and 1986 ocular estimates and the 1986 transect data are included in this report.

A historical change assessment of the land/water ratio has been prepared to show the cumulative impacts over time of natural subsidence, erosion, compaction, and saltwater intrusion. Five sets of aerial photos, from 1953, 1971, 1980, 1983, and 1985, were used for comparison. The acreage of land and water was planimetered for each of the five years. Changes in the land/water are displayed with maps and in tabular form.

Erratic water level fluctuations contribute to increased marsh erosion rates and reduce the ability of vegetation to reestablish in open water areas. Tide levels, both inside and outside of the management area, have been monitored by TLT at one weir location to assess if the fluctuations are being reduced in the management area. Tide data is presented in both tabular and linear graph form.

RESULTS AND DISCUSSION

Salinity

Salinity was monitored at 12 sites (see Figure 1) by TLT from 11/11/85 - 11/26/86. This data has been summarized in Table 1 and in linear graphs (Figures 5-16). Salinity readings recorded during the 1982 HEP and 1986 evaluation are included in Table 2.

The TLT data revealed that salinity levels are consistently higher inside the management area than outside of the area. This is graphically illustrated in Figures 5, 6, and 7.

Table 5, below, summarizes the average salinities for the 12 TLT sites.

TABLE 5
Average Salinity (ppt)

<u>Station</u>	<u>Inside Area</u>	<u>Outside Area</u>
1 (weir)	4.21	3.64
2 (weir)	.961	.825
3 (weir)	1.26	1.17
4	5.26	
5	5.07	
6	4.32	
7	4.66	
8	4.37	
9	3.86	
10 (canal)	3.58	3.85
11 (Lake DeCade)		4.40
12 (Fallout Canal)		6.81

Since salinity averages are higher inside the area than outside, it may be concluded that (1) freshwater entering from the Marmande Canal is not circulating through the area as proposed, or (2) the flap gates on the variable created weir is opened too often, allowing water high in salinities to enter the area, or (3) other reasons.

A comparison of salinity readings taken during the 1982 HEP and the 1986 transect evaluation indicate that salinities have dropped significantly in four years. (See Table 2). SCS personnel who helped develop this management plan and have knowledge of the area have stated that salinities were commonly in the 12-13 ppt range before the structural measures were installed. Based on this limited information, it seems that the plan components are working to a degree.

Vegetation

The TLT management area was shown to be fresh marsh vegetated entirely by Paille fine (Panicum hemitomom) in 1953. By 1982 it was converted to fresh/intermediate/brackish marsh with large open water areas - many unproductive. (Cutshall, 1982)

Table 2 and Table 3 summarize the vegetative ocular survey estimates conducted in 1982 and 1986. The two surveys provide a comparison of vegetative communities before and after the planned structural measures were installed. Table 4 is a summary of the vegetation recorded on the transects established in November 1986.

Table 6 illustrates the changes in marsh types (fresh/intermediate/brackish) at the HEP sites before and after the management plan was implemented. These determinations were based on the ocular estimates, vegetative transects and salinity data. Figures 21 and 22 further reflect these findings.

TABLE 6
Marsh Types
Station Numbers

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	29
1982	B	B	B	B	I	B	B	B	B	B	B	B	I	I	I	I	I	I	F	F	F	F	F	F
1986	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	F	F	F	F	F

F = Fresh Marsh or Open Water Area

I = Intermediate Marsh or Open Water Area

B = Brackish Marsh or Open Water Area

Salinity and vegetative data indicate that sites 2, 3, 4, 6, 7, 8, 11, and 12, which were brackish in 1982, can now be classified as intermediate marsh or open water. These conclusions are based on a very limited amount of data with emphasis on water salinity. Brackish marsh has an average salinity of 8.0 ppt and intermediate marsh has an average salinity of 3.3 ppt. (USDA Soil Conservation Service, 1978). Sites which were strongly brackish marsh in 1982 have average salinities ranging from 4.21 - 5.26 (refer to Table 5). This is approaching the intermediate level.

Vegetative response is slow but there are signs that fresh/intermediate species are invading brackish areas. Bacopa monnieri and Eleocharis parvula, both classified as increaser species, are now more prevalent in areas which were mud flats and small open water. These plants are the first to become established in areas devoid of vegetation. They provide a substrata on which perennial species can grow.

Open water sites 5, 6, 7, 8, 11, 12, and 17, formerly dominated by Ruppia maritima, a plant normally found in strong brackish water, now have Myriophyllum heterophyllum, Ceratophyllum demersum, or open water present. These plants are another indication that brackish areas are turning intermediate. (USDA Soil Conservations Service, 1978).

Significant vegetative response to the management plan may take several years. Only by continuing an effective monitoring program will observed changes be documented.

HISTORICAL CHANGE ASSESSMENT

Drastic changes have occurred in the TLT marsh during the past 33 years. In 1953 the entire area was fresh marsh with open water comprising only 15 acres of the 7,014 acre tract. Deterioration of the marsh began about 1962 with the opening of the Houma Navigation

Canal, which provided a direct avenue of saltwater to the area via the Falgout Canal. In the mid 1960's hurricanes Betsy and Hilda hit the area, bringing in saltwater. The pipeline canal was dug, transecting the area east and west, and spoil was placed on both sides of the canal, cutting off all freshwater recharge from the Marmande Canal. Oil exploration canals into the marsh compounded the problem by providing ingress of saline water into the area. (Cutshall, 1982).

Figures 17, 18, 19 and 20 illustrate the changes in open water for 1953, 1971, 1983 and 1985.

Table 7 below shows the land/water acreages for years 1953, 1971, 1980, 1983, and 1985.

Table 7
Marsh/Water Ratios
Years 1953, 1971, 1980, 1983 and 1985

<u>Years</u>	<u>Marsh</u>	<u>Water</u>
1953	6,999	15
1971	5,729	1,285
1980	4,855	2,159
1983	4,727	2,389
1985	4,269	2,745

TIDE EVALUATIONS

Tide evaluations were monitored both inside and outside the management area at the weir, (Station no. 1) (Figure 1). Tide elevation dates are presented in Table 1 and is illustrated graphically in Figure 4. Structural measures (weirs, levees, and water circulation channels) were installed to alleviate saltwater intrusion, allow additional freshwater to circulate in brackish areas and stabilize water levels.

Structures have been successful in stabilizing water levels. The outside average difference in water elevations between monitoring dates is .214 feet. The inside average difference is .114 feet. This is a 100% reduction in water level fluctuations in the management area.

LITERATURE CITED

- Soileau, David M. 1984. Final Report on the Tenneco Laterre Corporation Mitigation Banking Proposal, Terrebonne Parish, Louisiana. USDI, U. S. Fish and Wildlife Service, p. 4.
- Cutshall, Jack R. 1982. Marsh Management Plan, Tenneco Laterre Mitigation Banking Project Area, USDA, Soil Conservation Service.
- USDA, Soil Conservation Service, 1978. Gulf Coast Wetlands Handbook

TABLE I
 SALINITY AND TIDE GAUGE READINGS
 ON
 TENNECO LATERRE MARSH MANAGEMENT AREA
 Stations 1-7

Date Taken	SALINITY - Measured in Parts Per Thousand								Readings are referred to marsh level as being +1.0' mean low water	
	Station 1		Station 2		Station 3		Sta.	Sta.	Sta.	Sta.
	In-side	Out-side	In-side	Out-side	In-side	Out-side	4	5	6	7
11-11-85	7		2					4		
2-25-86										
3-13-86	7	4					7		4	
3-17-86	7	4	2	2	2	2	7	5	5	
3-18-86		5								
3-20-86	4	5	3	2	3	2	4	3	4	3
3-25-86	5	4	4	3	3	3	5	5	5	4
3-27-86	7	2					5	5	5	0.35
4-1-86	3	2	2	2	2	2	7	6	6	0.40
4-3-86	3	2								0.60
4-7-86	10	6	4	2	3	3	6	10	7	0.50
4-9-86	6	6	2	1	2	1	6	5	6	0.60
4-10-86	5	3								0.50
4-11-86	5	6	0	0	1	0	7	6	5	0.50
4-15-86	3	4					6		4	0.55
4-17-86	7	4								0.50
4-18-86	5	3								0.50
4-21-86	5	3					6		4	0.60
4-24-86	7	3	0	2	0	0	5	5	4	0.60
4-29-86	5	4								0.60
5-2-86	4	2	1	1	1	1	6	6	5	0.60
5-5-86	3	3								0.50
5-8-86	4	4	1	0	1	1	7	7	6	0.60
5-12-86	8	7	2	2	2	2	8	6	5	1.00
5-14-86	5	5								1.05
5-15-86	6	5								1.00
5-22-86	5	4					6		5	1.00
5-28-86	6	5							7	1.20
5-30-86	4	3								0.90
6-6-86	5	3	3	3	3	3	8	6	7	1.10
6-09-86	4	3	0	0						1.60

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Date Taken	SALINITY - Measured in Parts Per Thousand								Readings are referred to marsh level as being +1.0' mean low water			
	Station 1 In-side	Out-side	Station 2 In-side	Out-side	Station 3 In-side	Out-side	Sta. 4	Sta. 5	Sta. 6	Sta. 7		
									Tide Gauge Station 1			
									Inside	Outside		
6-12-86	7	6									1.40	1.00
6-13-86	5	5									1.30	0.70
6-17-86	3	4									1.15	0.75
6-18-86	5	5									1.10	0.85
6-27-86	6	5	3	2	2	3	6	4	5	6	1.10	1.20
6-30-86	4	4									1.20	1.00
7-2-86	4	4									1.00	1.10
7-9-86	3	4		2							0.80	0.99
7-10-86	5	3									0.80	0.70
7-11-86	0	2									0.90	0.80
7-14-86	3	2	2	2	2	2	5	5	5	4	0.90	0.60
7-16-86	3	3					4	4	4	3	0.70	0.60
7-18-86	3	4									0.80	0.70
7-21-86	3	2									0.60	0.40
7-23-86	2	1									0.60	0.40
7-25-86	3	1	0	0	0	0	3	3	3	2	0.50	0.45
7-28-86	3	1									0.60	0.70
7-30-86	2	1									0.60	0.50
8-1-86	3	1	2	1	1	1	4	4	3	2	0.50	0.40
8-4-86	2	1									0.50	0.50
8-6-86	1	1									0.50	0.45
8-8-86	0	0	0	0	0	0	1.5	2	2	.5	0.55	0.55
8-11-86	0	0									0.80	0.70
8-13-86	0	0									0.70	0.80
8-15-86	0	0	0	0	1	1	1	2	3	0	0.70	0.90
8-18-86	1	1									0.80	0.70
8-21-86	0	0	0	0			2			1	0.80	0.70
8-25-86	1	0									0.60	0.50
8-27-86	1	0.5									0.60	0.60
8-29-86	0.5	0									0.55	0.50
9-3-86	8	6	0	0	0	0	9	5	3	7	0.88	1.10

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 ON
 TENNECO LATERRE MARSH MANAGEMENT AREA
 Stations 1-7

Date Taken	SALINITY - Measured in Parts Per Thousand												Readings are referred to marsh level as being +1.0' mean low water		
	Station 1		Station 2		Station 3		Sta.	Sta.	Sta.	Sta.	Tide Gauge Station 1	Inside	Outside		
	In-side	Out-side	In-side	Out-side	In-side	Out-side	4	5	6	7					
9-4-86	6	6										0.80		1.15	
9-5-86	5	5						7			6	0.90		1.00	
9-8-86	3	4	0	0	0	0	5	5	3	4		0.85		0.70	
9-10-86	7	6										0.90		1.00	
9-12-86	5	4	1	2	0	0	6	7	2	6		0.90		1.30	
9-15-86	5	4										1.05		1.00	
9-16-86	6	6										1.00		1.10	
9-19-86	11	9	0	0	0	0	8	8	5	8		1.05		1.10	
9-22-86	13	12	.5	0			9			15		1.20		1.20	
9-24-86	8.5	10		1								1.35		1.20	
9-26-86	6.5	6	0	0								1.20		1.35	
9-30-86	7	8										1.20		1.30	
10-1-86	6	8	0	0	0	0	7	6	4	10		1.25		1.35	
10-3-86	5	10					10			11		1.10		1.40	
10-6-86	5	5	0	0			7			10		1.35		1.20	
10-8-86	3.5	3	0	0								1.30		1.30	
10-10-86	6	4	0	0								1.40		1.30	
10-13-86	4	4	0	0			4			3		1.50		1.60	
10-15-86	1	2					3			2		1.30		1.10	
10-17-86	5	4	2	2			5			4		1.20		-0.10	
10-21-86	1	2	0	0			5			4		0.60		0.60	
10-24-86	6	6	1	1			2.5			4		0.90		1.70	
10-28-86	3.5	3.5						3	0.5			1.20		0.60	
10-30-86		3		0								1.00		0.85	
11-4-86	1.5	1	0	0								1.10		1.35	
11-7-86	2.5	1.5	0	0			2			2		1.25		1.40	
11-10-86	3	2	0	0			2			2		1.20		0.90	
11-17-86	1	1										1.00		1.00	
11-24-86	1.5	2					2.5			2.5		1.10		1.30	
11-26-86	0	0					0			0		1.40		1.30	

TABLE I
SALINITY AND TIDE GAUGE READINGS
ON
TENNECO LATERRE MARSH MANAGEMENT AREA
Stations 8-12

SALINITY - Measured In Parts Per Thousand

Date Taken	Sta. 8	Sta. 9	Station 10 In-side	Out-side	Station 11 Lk. DeCade	Station 12 Fallout Cn1
3-17-86	5					
3-20-86	4	4				
3-25-86	5	4				
4-1-86	5	5				
4-7-86	5					
4-9-86	4	5				
4-11-86	5	5				
4-24-86	3	4				
5-2-86	5	3				
5-8-86	3	3				
5-12-86	3	4				
5-30-86					5	
6-6-86	6	5				
6-27-86	4	4				
7-9-86						3
7-14-86	6	7				
7-16-86	3	4				
7-25-86	3	3				
8-1-86	4	3				
8-8-86	3	3	0			
8-15-86	3	2	1			
8-29-86			1			
9-3-86	5	2				
9-8-86	5	3	2			
9-12-86	5	2	3			
9-19-86	6	5	5			14
9-22-86			5		4	
9-24-86			4.5			
9-26-86			6.5		5.5	7.5
9-30-86			6	8	7	11
10-1-86	5	5	7			

TABLE I
 SALINITY AND TIDE GAUGE READINGS
 ON
 TENNECO LATERRE MARSH MANAGEMENT AREA
 Stations 1-7

Date Taken	SALINITY - Measured in Parts Per Thousand								Readings are referred to marsh level as being +1.0' mean low water		
	Station 1		Station 2		Station 3		Sta.	Sta.	Sta.	Tide Gauge Station 1	
	In-side	Out-side	In-side	Out-side	In-side	Out-side	4	5	6	Inside	Outside
9-4-86	6	6								0.80	1.15
9-5-86	5	5					7		6	0.90	1.00
9-8-86	3	4	0	0	0	0	5	5	3	0.85	0.70
9-10-86	7	6								0.90	1.00
9-12-86	5	4	1	2	0	0	6	7	2	0.90	1.30
9-15-86	5	4								1.05	1.00
9-16-86	6	6								1.00	1.10
9-19-86	11	9	0	0	0	0	8	8	5	1.05	1.10
9-22-86	13	12	.5	0			9		15	1.20	1.20
9-24-86	8.5	10		1						1.35	1.20
9-26-86	6.5	6	0	0						1.20	1.35
9-30-86	7	8								1.20	1.30
10-1-86	6	8	0	0	0	0	7	6	4	1.25	1.35
10-3-86	5	10					10		11	1.10	1.40
10-6-86	5	5	0	0			7		10	1.35	1.20
10-8-86	3.5	3	0	0						1.30	1.30
10-10-86	6	4	0	0						1.40	1.30
10-13-86	4	4	0	0			4		3	1.50	1.60
10-15-86	1	2					3		2	1.30	1.10
10-17-86	5	4	2	2			5		4	1.20	-0.10
10-21-86	1	2	0	0			5		4	0.60	0.60
10-24-86	6	6	1	1			2.5		4	0.90	1.70
10-28-86	3.5	3.5						3	0.5	1.20	0.60
10-30-86		3		0						1.00	0.85
11-4-86	1.5	1	0	0						1.10	1.35
11-7-86	2.5	1.5	0	0			2		2	1.25	1.40
11-10-86	3	2	0	0			2		2	1.20	0.90
11-17-86	1	1								1.00	1.00
11-24-86	1.5	2					2.5		2.5	1.10	1.30
11-26-86	0	0					0		0	1.40	1.30

OCULAR ESTIMATES OF DOMINANT VEGETATION

FOR YEARS 1982 and 1986 ^{1/}Transect Numbers ^{2/} and Dates Evaluated

Vegetative Species by Marsh Type	1 ^{3/} '82 '86	2 ^{4/} '82 '86 ^{5/}	3 ^{6/} '82 '86	4 ^{7/} '82 '86	5 ^{8/} '82 '86	6 ^{9/} '82 '86	7 ^{10/} '82 '86 ^{11/}	8 ^{12/} '82 '86 ^{13/}	10 ^{14/} '82 '86	11 ^{15/} '82 '86	12 ^{16/} '82 '86	13 ^{17/} '82 '86	14 ^{18/} '82 '86	
<u>FRESH MARSH</u>														
1. <i>Panicum</i> <i>capillare</i>														60
2. <i>Dactyloctenium</i> <i>languineum</i>		Tr												10
3. <i>Lagurus</i> <i>acutus</i>														15 Tr
4. <i>Sacciolepis</i> <i>strobilacea</i>														
5. <i>Leymus</i> <i>ovalis</i>														
6. <i>Mitchella</i> <i>repens</i>														
7. <i>Myrsinaceae</i>														
8. <i>Myriophyllum</i> <i>spicatum</i>														
9. <i>Myriophyllum</i> <i>intermedium</i>														
10. <i>Myriophyllum</i> <i>spinosissimum</i>														
11. <i>Myrica cerifera</i>														
12. <i>Polygonum</i> species														
13. <i>Andropogon</i> <i>glomeratus</i>	Tr		Tr						Tr	—				Tr
14. <i>Phragmites australis</i>														5
15. <i>Rigidia</i> sp.														Tr Tr
16. <i>Leersia</i> <i>virginica</i>														Tr
17. <i>Panicum</i> <i>maritimum</i>														
18. <i>Sagittaria</i> <i>montereyensis</i>														Tr
19. <i>Dichromena</i> <i>colorata</i>														
20. <i>Alternanthera</i> <i>philoxeroides</i>														50
21. Green Filamentous algae														2/ 2/
<u>INTERMEDIATE MARSH</u>														
1. <i>Typha latifolia</i>		Tr	Tr											40 5 50
2. <i>Equisetum</i> sp.	5			10	Tr	5								Tr Tr
3. <i>Ruppia</i> sp.	10			Tr	15	Tr	15							
4. <i>Paspalum</i> <i>vaginatum</i>														
5. <i>Eriochloa</i> <i>caroliniana</i>	Tr				Tr									Tr
<u>BRACKISH MARSH</u>														
1. <i>Aster</i> sp.														5
2. <i>Spartina patens</i>	50	90	90	70	90	60	1/	1/						
3. <i>Scirpus americanus</i>	15	Tr		Tr		15								25
<u>STRONG BRACKISH MARSH</u>														
1. <i>Ruppia</i> <i>maritima</i>														
2. <i>Distichlis</i> <i>spicata</i>	15	5	Tr	5	Tr	5								
Salinity (ppt)	1/	4.0	13.0	1/	11.0	2.5	1/	3.5	1	4.0	9.0	3.5	6.0	2.0
Water (Percent)											90	100	100	100
											100	100	100	100

1/ Not Evaluated

2/ W-Vegetation present in water

3/ I-Vegetation present on islands

4/ Transects 9, 24, 25, 26, 27 and 28 are on spoil bank and were not evaluated in '86

5/ Ocular estimates obviously taken at different locations

6/ The site was reseeded in 1986

7/ *Myrica cerifera* is dying

8/ P-Vegetation present but no percentage recorded

9/ Site will be reestablished next year

10/ Ocular estimate taken by REP team 7/10/86

11/ Estimates are identified as percent or trace (Tr)

12/ No vegetation present

TABLE 2

ESTIMATES OF DOMINANT VEGETATION

OR YEARS 1982 AND 1986

Numbers % and Dates Evaluated

Vegetative Species by NASA Type	12	13	14	15	16 ^{1/}	17 ^{2/}	18	19	20	21 ^{3/}	22 ^{4/}	23 ^{5/}	24 ^{6/}	
	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	'82 '86	
<u>FRESH MARSH</u>														
1. <i>Panicum</i> <i>capillare</i>								30						10
2. <i>Spartina alterniflora</i>			40											
3. <i>Spartina virginica</i>														40
4. <i>Leymus</i> <i>arenarius</i>														
5. <i>Mystacanthus capillaris</i>														
6. <i>Heterocystis</i> See.														
7. <i>Scirpus</i> <i>cristatum</i>														10
8. <i>Kyllinga nudiflora</i>														
9. <i>Mixta</i> <i>caroliniana</i>														
10. <i>Mixta caroliniana</i>														
11. <i>Polygonum</i> species														20
12. <i>Anemone</i> <i>canadensis</i>														
13. <i>Priva lappulacea</i>														
14. <i>Bidens</i> species														15
15. <i>Leguminosae</i> <i>virginicus</i>														
16. <i>Panicum americana</i>														
17. <i>Spartina angustifolia</i>														
18. <i>Dichromena colorata</i>														
19. <i>Grossularia</i> <i>oblongifolia</i>														
<u>INTERMEDIATE MARSH</u>														
1. <i>Type</i> <i>latifolia</i>														
2. <i>Zizaniopsis</i> See.	40	5	50	10			15							
3. <i>Equisetum</i> species														15
4. <i>Paspalum virginicum</i>														
5. <i>Ligustris</i> <i>ovalifolia</i>														
<u>BRACKISH MARSH</u>														
1. <i>Acorus</i> See.														
2. <i>Scirpus</i> species														
3. <i>Scirpus</i> <i>olberti</i>														
<u>STRONG BRACKISH MARSH</u>														
1. <i>Ruppia</i> species														
2. <i>Distichlis</i> <i>spicata</i>														
Salinity (ppt)	1	3.0	1/	1.5	1/	2.0	3.0	1.5	1/	1.5	5.0	1.5	3.2	2.5
Water (Percent)	100	100				50	80	80	100	30	100	30	100	100

1/ Not Evaluated

2/ V-Vegetation present in water

3/ I-Vegetation present on islands

4/ Transects 9, 21, 23, 26, 27 and 28 are on shell bank and were not evaluated in '86

5/ Ocular estimates previously taken at different locations

6/ The site was reseeded in 1986

7/ *Mixta caroliniana* is dying

8/ P-Vegetation present but no percentage recorded

9/ Site will be reestablished next year

10/ Ocular estimate taken by EEP team 7/10/86

11/ Estimates are identified as percent or trace (Tr)

12/ No vegetation present

Table 3
 Ocular Estimates of Sub-Dominant
 Vegetation For Years 1982 and 1986^{1/}
 Transect Numbers^{2/} and Dates Evaluated^{3/}

Vegetative Species by Marsh Type	1 '82	2 '86	3 '82	4 '86	5 '82	6 '86	7 '82	8 '86	9 '82	10 '86	11 '82	12 '86	13 '82	14 '86
FRESH MARSH														
1. <i>Lapelia nodiflora</i>														
2. <i>Sesbania exaltata</i>					1 Tr		1 2/							
3. <i>Ludwigia decurrens</i>														
4. <i>Lemna minor</i>														
5. <i>Solidago Sp.</i>														
6. <i>Saururus cernuum</i>														
7. <i>Eichornia crassipes</i>														
8. <i>Pistia stratiotes</i>														
9. <i>Eudatorium capillifolium</i>														
10. <i>Cyperus valliscaea</i>														
11. <i>Scirpus validus</i>														
12. <i>Drosera erythrorhiza</i>														
13. <i>Nutella luteum</i>														
14. <i>Lilaeopsis carolinensis</i>														
15. <i>Sporobolus (Dropseed)</i>			Tr											
16. <i>Carex Sp.</i>				Tr										
INTERMEDIATE MARSH														
1. <i>Cyperus Sp.</i>	Tr		Tr	Tr	Tr		1 2/							
2. <i>Amaranthus cannabinus</i>														
3. <i>Lycopus albus</i>	Tr						1 2/							
4. <i>Vitis aestivalis</i>							1 2/							
5. <i>Echinochloa polystachya</i>							1 2/							
6. <i>Amaranthus palmeri</i>	Tr						Tr							
7. <i>Ipomoea pes-caprae</i>											Tr			
8. <i>Houttuynia cordata</i>											Tr			
9. <i>Asclepias speciosa</i>														
10. <i>Eriogonum giganteum</i>														
11. <i>Iva ciliata</i>														
BRACKISH MARSH														
1. <i>Acsida albovenusta</i>		Tr												

^{1/} Not Evaluated
^{2/} No vegetation present in water
^{3/} Vegetation present on islands
^{4/} Transsects 9, 20, 23, 27 and 28 are on spoil bank and were not evaluated in '86
^{5/} Ocular estimates obviously taken at different locations
^{6/} The site was relocated in 1986
^{7/} Myrica cerifera is dying
^{8/} Vegetation is present but no percentage recorded
^{9/} Site will be resampled next year.
^{10/} Ocular estimate taken by HEP team / 10/86
^{11/} Estimates are identified as percent or Tr (trace)
^{12/} No vegetation present

Vegetative Species by Marsh Type	12 '82	13 '86	13 '82	14 1/2 '86	15 '82	16 1/2 '86	17 1/2 '84	18 '82	19 '86	20 '82	21 1/2 '86	22 1/2 '86	23 '82	23 1/2 '86
FRESH MARSH														
1. <i>Littorella ovaliflora</i>				Tr										
2. <i>Sesuvia exaltata</i>							Tr	1	1			P	Tr Tr	
3. <i>Ludwigia decurrens</i>						Tr	5	Tr	1			P	Tr	
4. <i>Lemna minor</i>				Tr			W/1							
5. <i>Solidago</i> Sp.										Tr Tr				
6. <i>Saururus cernuus</i>							Tr					P		
7. <i>Zizaniopsis</i> <i>STRUMIFOLIAE</i>				Tr			W/1					W/1		
8. <i>Pistia stratiotes</i>				Tr										
9. <i>Eupatorium</i> <i>Capillifolium</i>					Tr					Tr	P			
10. <i>Licania</i> <i>Millacea</i>									Tr		P	Tr		
11. <i>Scirpus validus</i>											P	Tr		
12. <i>Devopteris</i> <i>thevetiae</i>												Tr		
13. <i>Nuphar lutea</i>											W/1			W/1
14. <i>Liaconosis</i> <i>carolinensis</i>					Tr									
15. <i>Sporobolus</i> <i>(Droseroid)</i>														
16. <i>Carex</i> Sp.										Tr				
INTERMEDIATE MARSH														
1. <i>Cyperus</i> Sp.				Tr		Tr	Tr	Tr Tr			P	Tr		
2. <i>Amaranthus</i> <i>cannabina</i>							Tr	Tr						
3. <i>Lycium</i> linearis														
4. <i>Vitis</i> aestivalis				Tr			Tr				P	Tr Tr	Tr	
5. <i>Echinochloa</i> <i>COLYNTACHA</i>									Tr			Tr		
6. <i>Amaranthus</i> <i>cockerelli</i>														
7. <i>Ipomoea</i> sagittata														
8. <i>Kosteletzkya</i> <i>virginica</i>						Tr	Tr	Tr		Tr			Tr	
9. <i>Axonocnemis</i> <i>leptica</i>							Tr							
10. <i>Eriogonum</i> <i>ELATIIFOLIUM</i>				Tr	Tr	1				Tr Tr	Tr	Tr P		
11. <i>Iva ciliata</i>						1				1				
BRACKISH MARSH														
1. <i>Achillea</i> <i>Salicifolia</i>														

1/ Not Evaluated

W= Vegetation present in water

I= Vegetation present on islands

Transsects 9, 14, 23, 27 and 28 are on spoil bank and were not evaluated in '86

Ocular estimates obviously taken at different locations

The site was relocated in 1986

Myrica cerifera is dying

** Vegetation is present but no percentage recorded

Site will be reestablished next year.

Ocular estimate taken by HEP team / 10/86

Estimates are identified as percent or Tr (trace)

No vegetation present

TABLE 4
VEGETATIVE TRANSECT DATA - 1986

Transects 2/3/

	1	2	3	4	5	6 ^{1/}	7 ^{1/}	8	11	12	13	14	15	16	17	18	19	20	22	23	29
<u>FRESH MARSH</u>																					
1. <i>Dichromena colorata</i>	3											2									
2. <i>Polygonum</i> Spe.	4	-									3	12	6			20	13	13	6		
3. <i>Sagittaria fasciata</i>	3										14					18	9		11	14	12
4. <i>Andropogon glomeratus</i>	5											12	4				6			4	
5. <i>Scirpus sylvaticus</i>	3										6	12	9		12	9	11	12	20	5	
6. <i>Myriophyllum heterophyllum</i>		27			100		50		100												
7. <i>Hydrocotyle</i> Spe.		7										12	4	8	8	2	13				
8. <i>Curaçayphyllum demersum</i>								50		15	20	4								2	
9. <i>Panicum diguetiiiflorum</i>												4	8	8							
10. <i>Scirpus californicus</i>										7								2		10	
11. <i>Lippia nodiflora</i>										5											
12. <i>Sebania exaltata</i>										2											
13. <i>Lemna minor</i>											20		14							12	
14. <i>Ludwigia decurrens</i>											8	4	6	3	2					5	
15. <i>Eichornia crassipes</i>											1	6									
16. <i>Myrica cerifera</i>															11			12			
17. <i>Solidago</i> Spe.																2					
18. <i>Panicum hemitomon</i>																9					
19. <i>Sagittaria montevidensis</i>																	20				
20. <i>Bidens laevis</i>																	15		16		
21. <i>Saururus cernuus</i>		-																	2		
22. <i>Filamentous green algae</i>							50														
23. <i>Phyla lanceolata</i>	3									2	10	6			2	35	16	12			
24. <i>Alternanthera philoxeroides</i>										5					18					2	
25. <i>Levisticum virginica</i>										7					5			17			
<u>INTERMEDIATE MARSH</u>																					
1. <i>Eleocharis</i> Spe.	6	13		10						2	6	3	11	10	8	20			12	10	
2. <i>Lythrum lineare</i>	13			5						3		2									
3. <i>Kosteletzkya virginica</i>	10										12	2	2		3		6				
4. <i>Vigna lutea</i>	5									2		2					12				
5. <i>Ipomoea sagittata</i>	2										2										
6. <i>Cyperus</i> Spe.	2	7		10						2		12	9	11	5						
7. <i>Echinocloa polystachya</i>	2		1										6								
8. <i>Amaranthus cannabinus</i>	2									2				2							
9. <i>Ammania coccinea</i>	2			10																	
10. <i>Eleocharis parvula</i>												8		17	11				4	2	
11. <i>Bacopa monnieri</i>	6	33	20	21						13		12	4	17	10				12	2	
12. <i>Typha latifolia</i>										5	10		6						10		
13. <i>Lycopodium fasciculare</i>												2		2							
14. <i>Aesculus hippocastanum</i>												4									
<u>SALTWATER MARSH</u>																					
1. <i>Spartina patens</i>	15	13	80	27						2	12	12		14		11					
2. <i>Pluchea camphorata</i>	2									2			3								
3. <i>Scirpus olneyi</i>	10			5							9								6	2	
<u>STRONG SALTWATER MARSH</u>																					
1. <i>Distichlis spicata</i>	2			12				50												10	
2. <i>Ruppia maritima</i>																					
Salinity at each transect	4.0	4.0	2.5	3.5	4.0	3.5	3.0	3.5	3.0	3.0	1.5	2.0	1.5	1.5	2.5	0.5	0.5	0.5	3.0	1.0	
Percentage of Transect in Water	0	40	18	9	100	100	100	100	100	100	0	54	72	27	54	9	9	0	0	0	9

1/ Water - No vegetation present

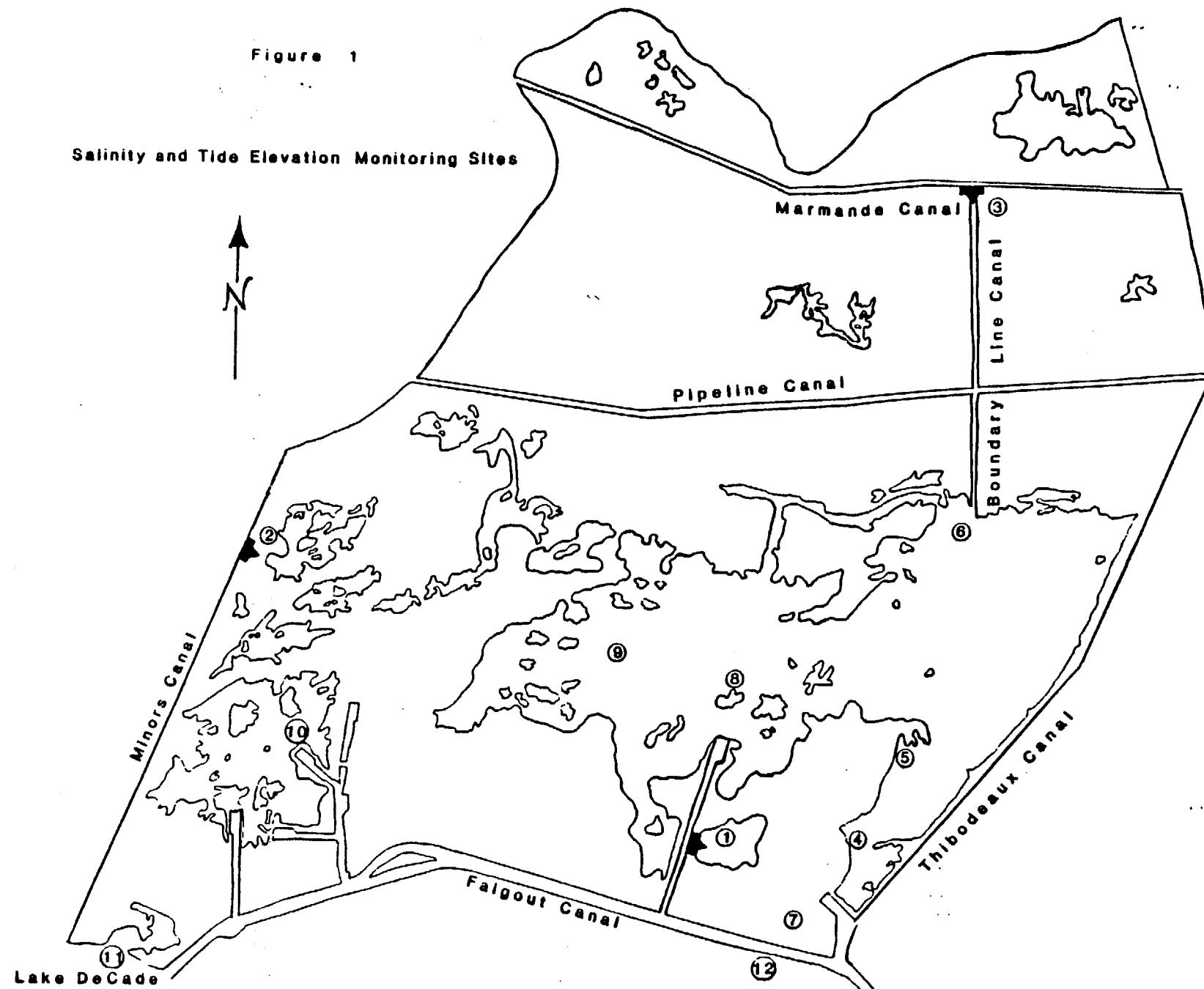
2/ Transects 9, 24, 25, 26, 27, and 28 are on spoil bank and were not evaluated in 1986.

Site no. 21 was evaluated at the wrong location in '86. It will be reevaluated in 1987.

MEP site no. 10 in '82 is now transect site no. 2.

3/ Percent of each species in relation to the other species identified on the transect.

Figure 1



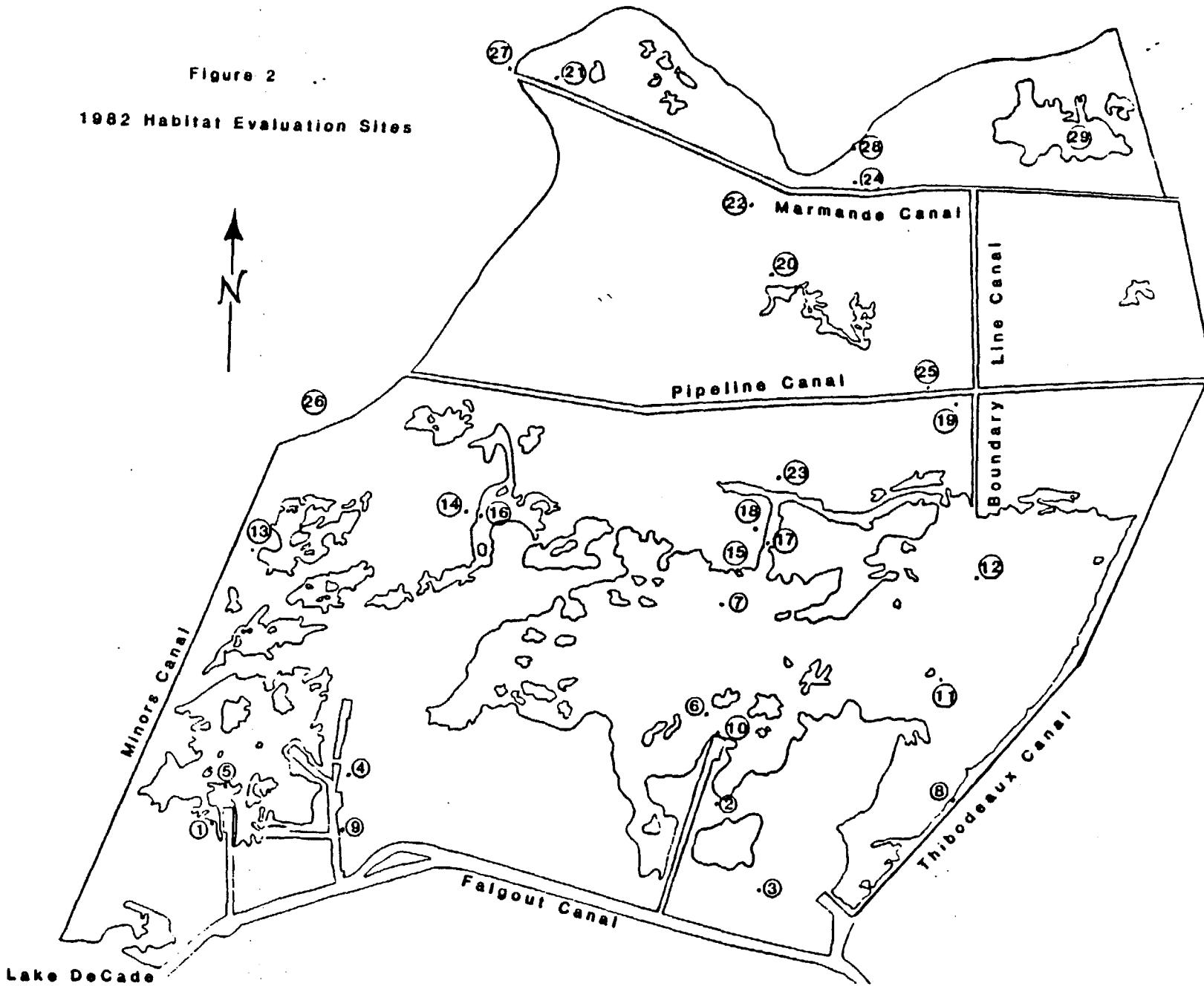
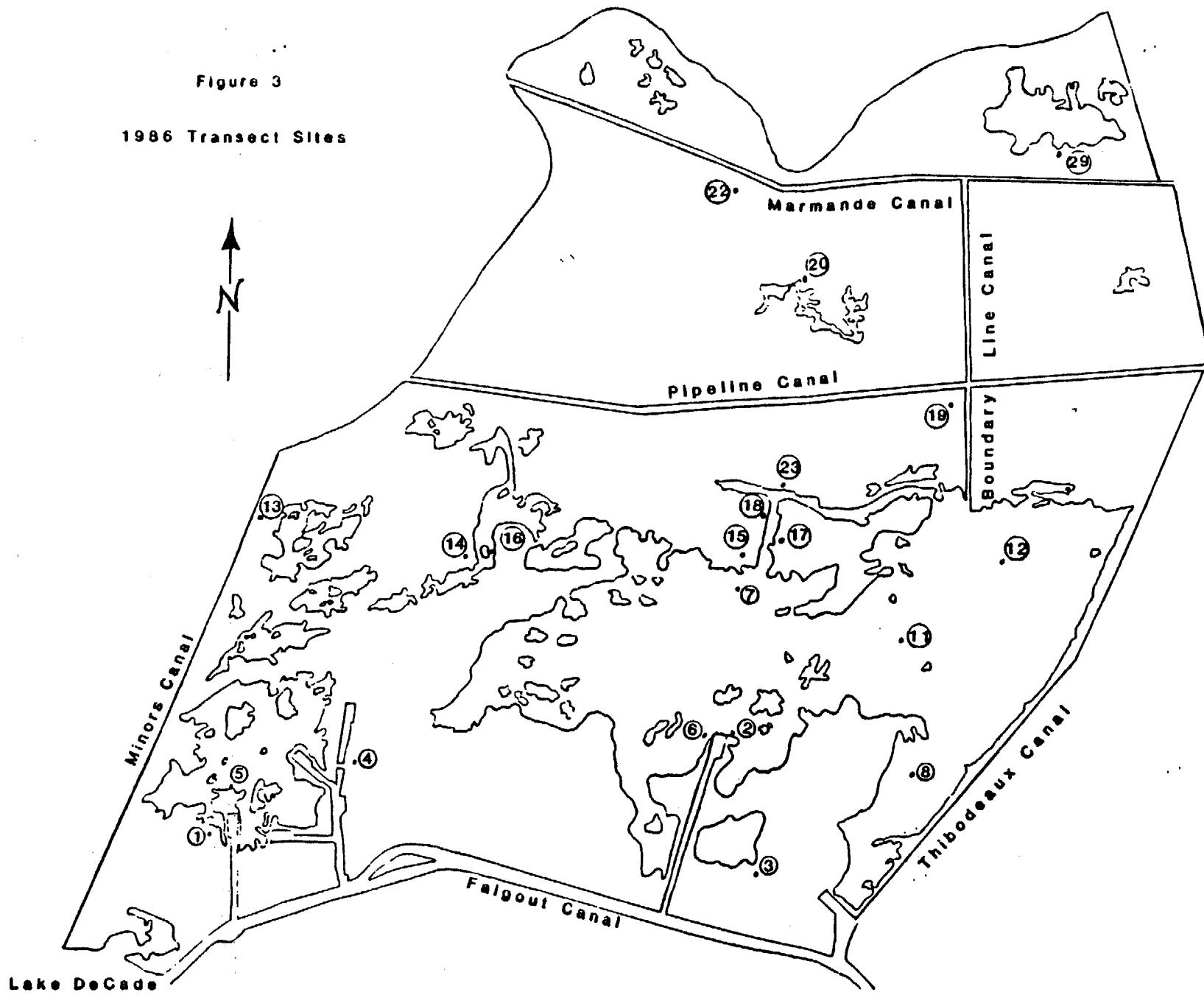
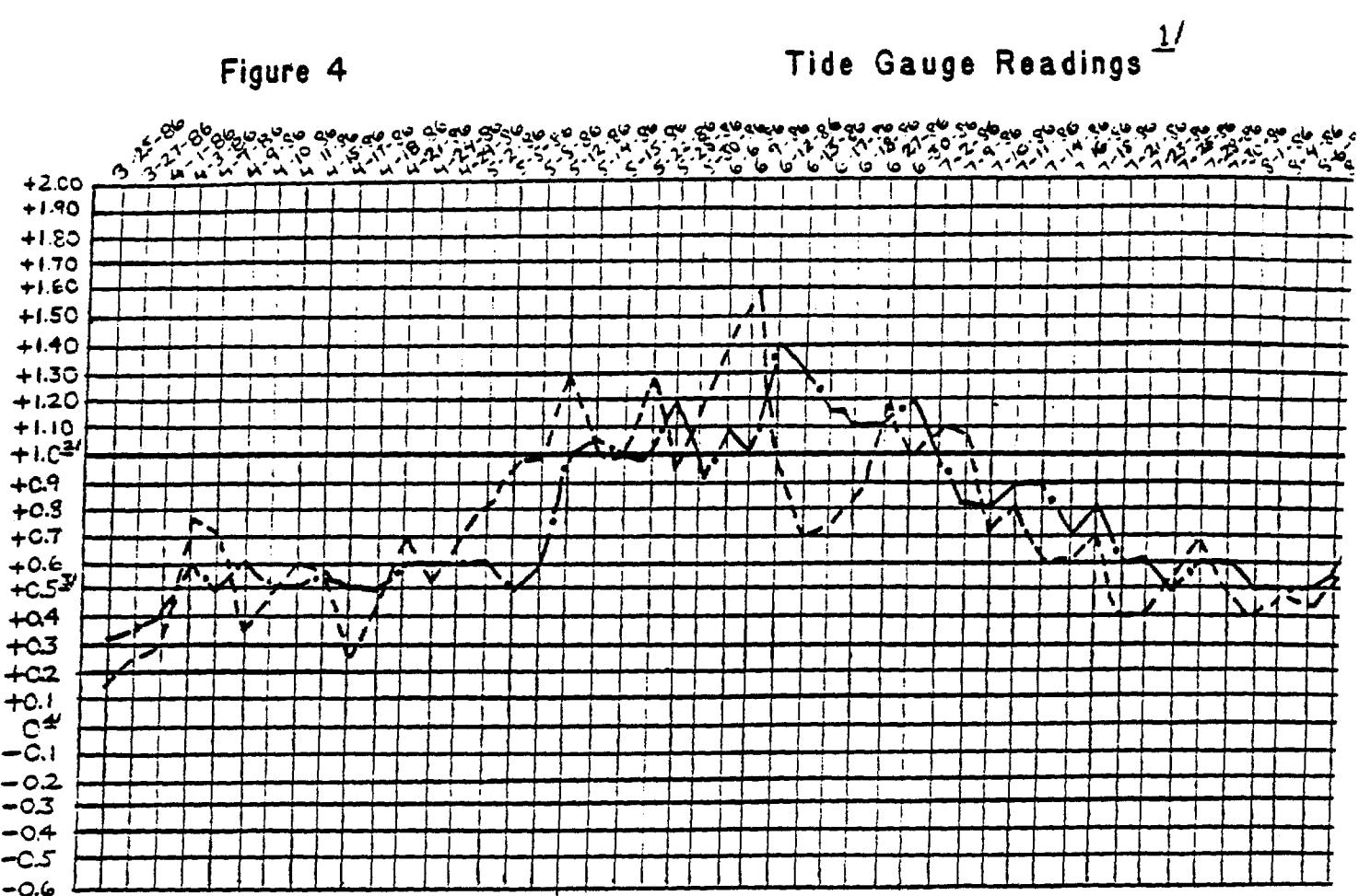


Figure 3

1986 Transect Sites

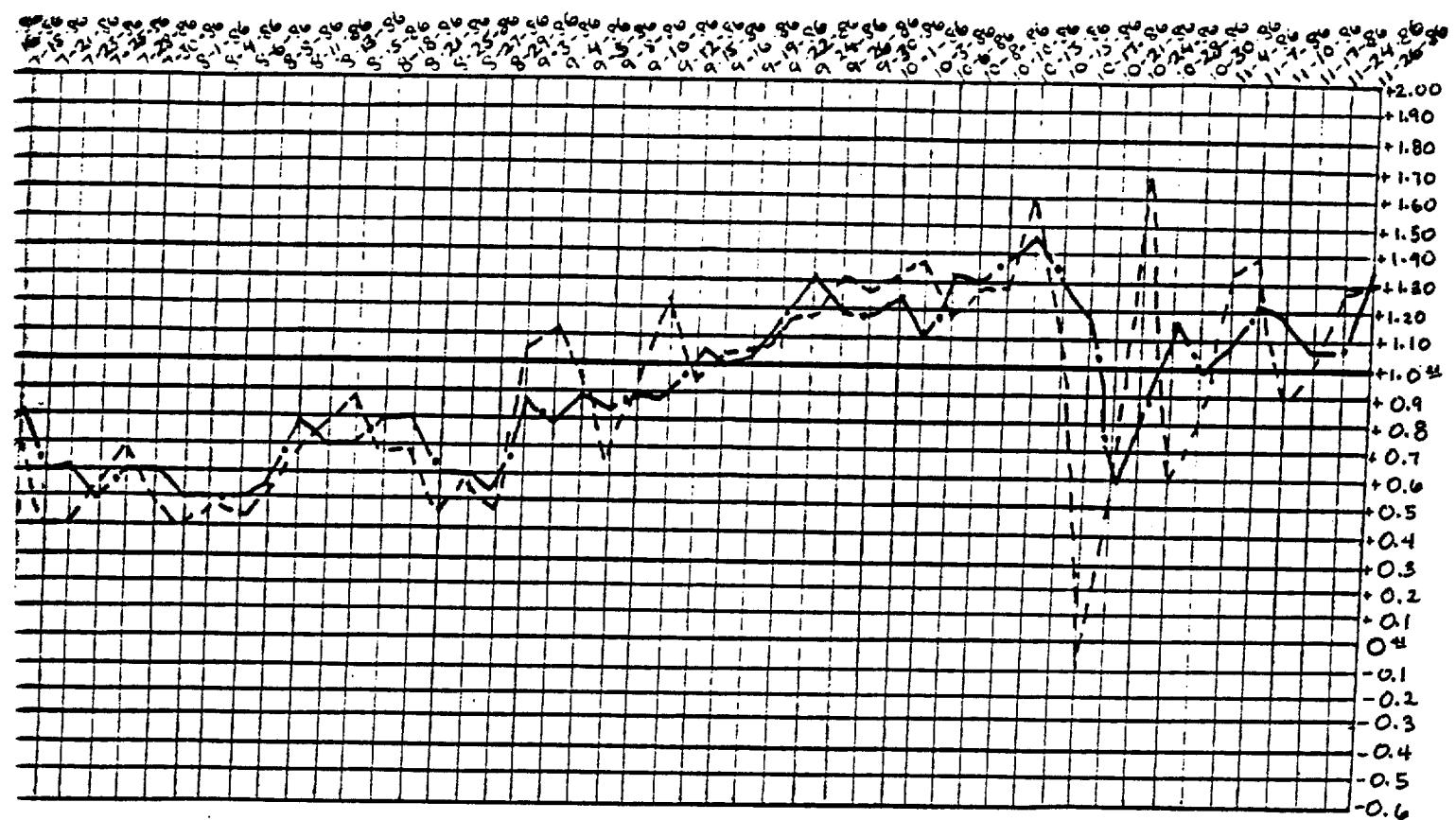


Tide Elevations



ings 1/

Sampling Dates



Outside Average water elevation = +.882

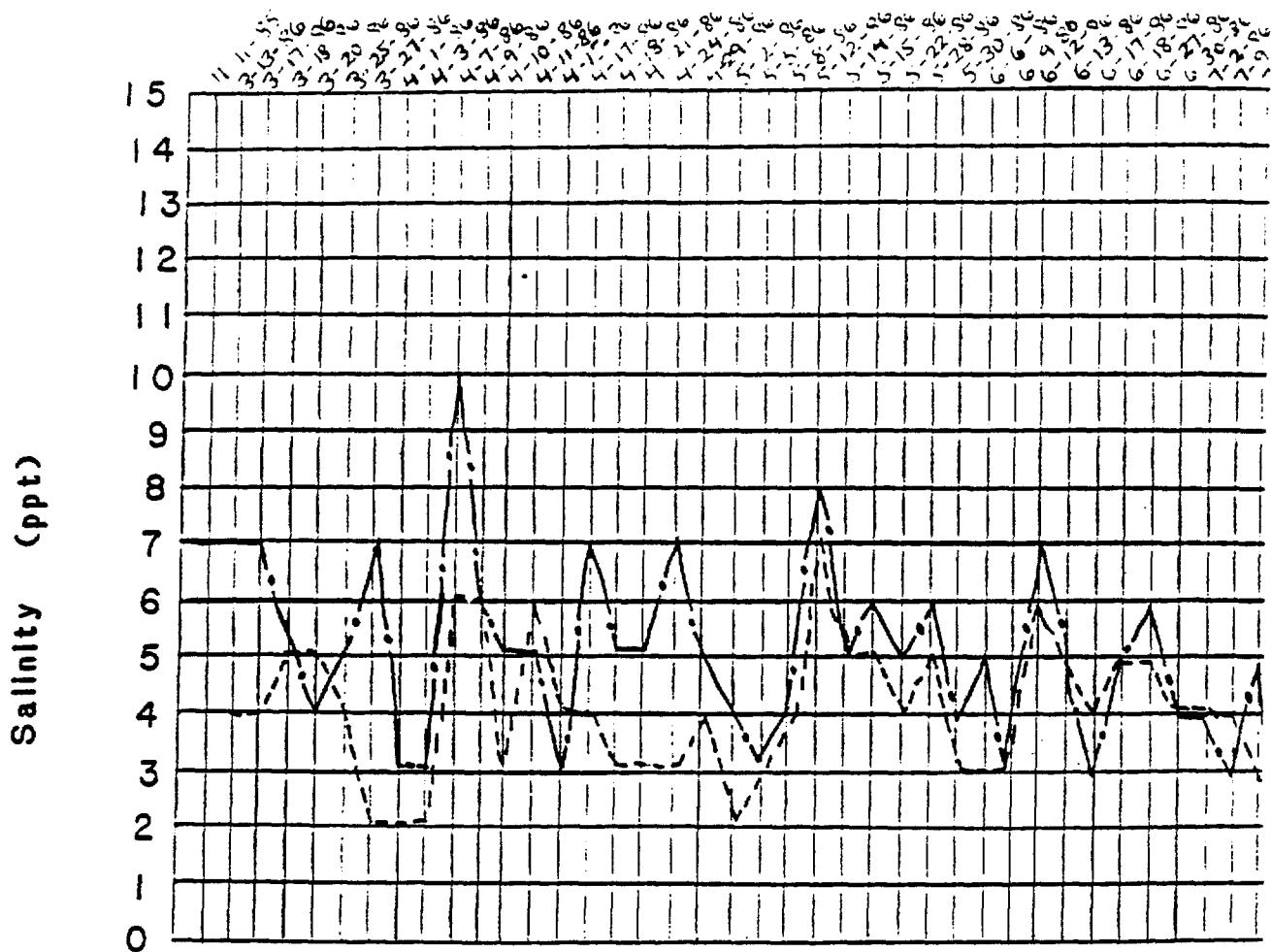
Inside Average water elevation = +.884

Outside Average difference in water elevations between monitoring dates = .214

Inside Average difference in water elevations between monitoring dates = .114

Salinity Readings

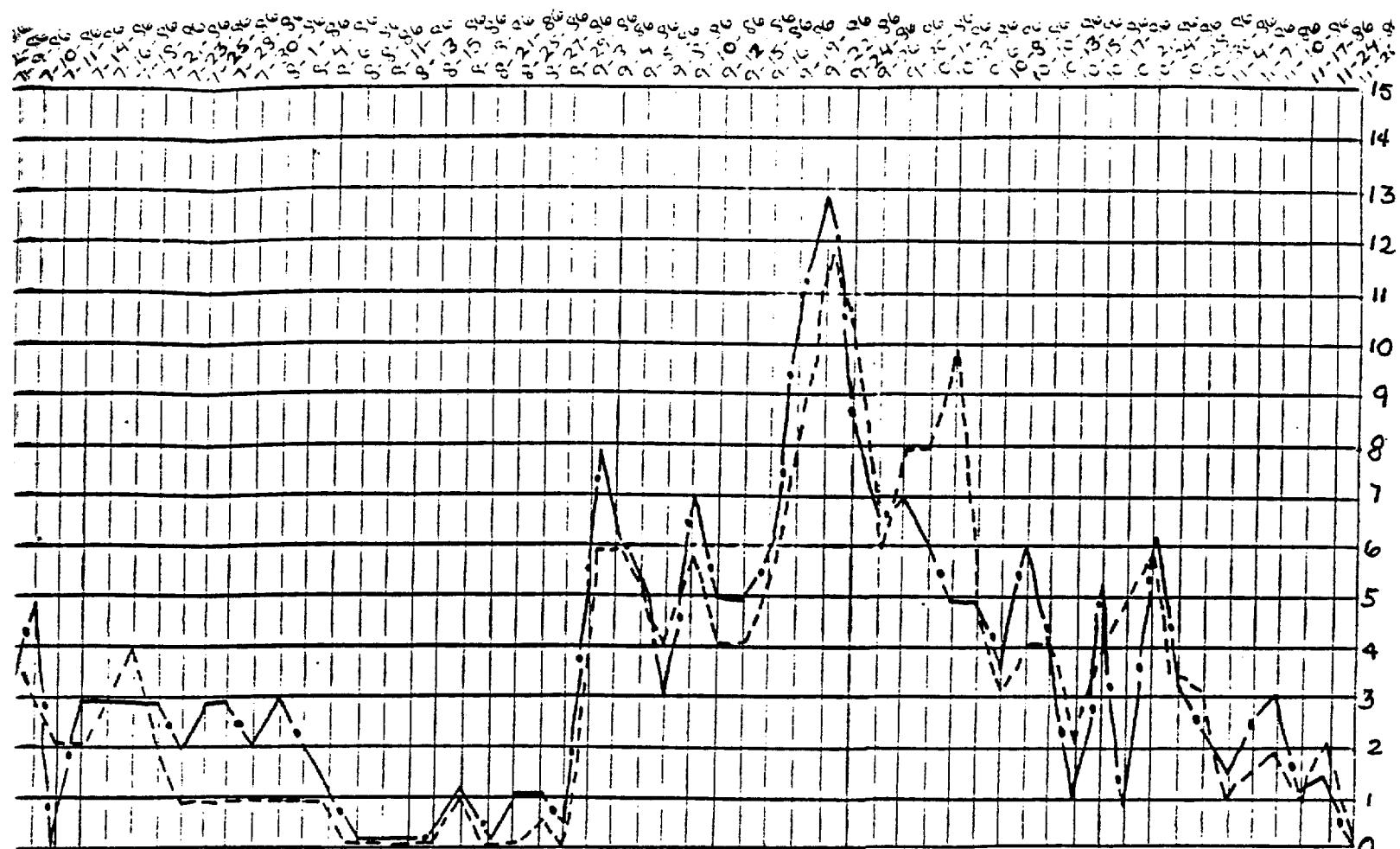
Figure 5



1/ Readings taken both Inside (—) and Outside (---) of weir at Station #1

Station 1 Weir 1

Sampling Dates

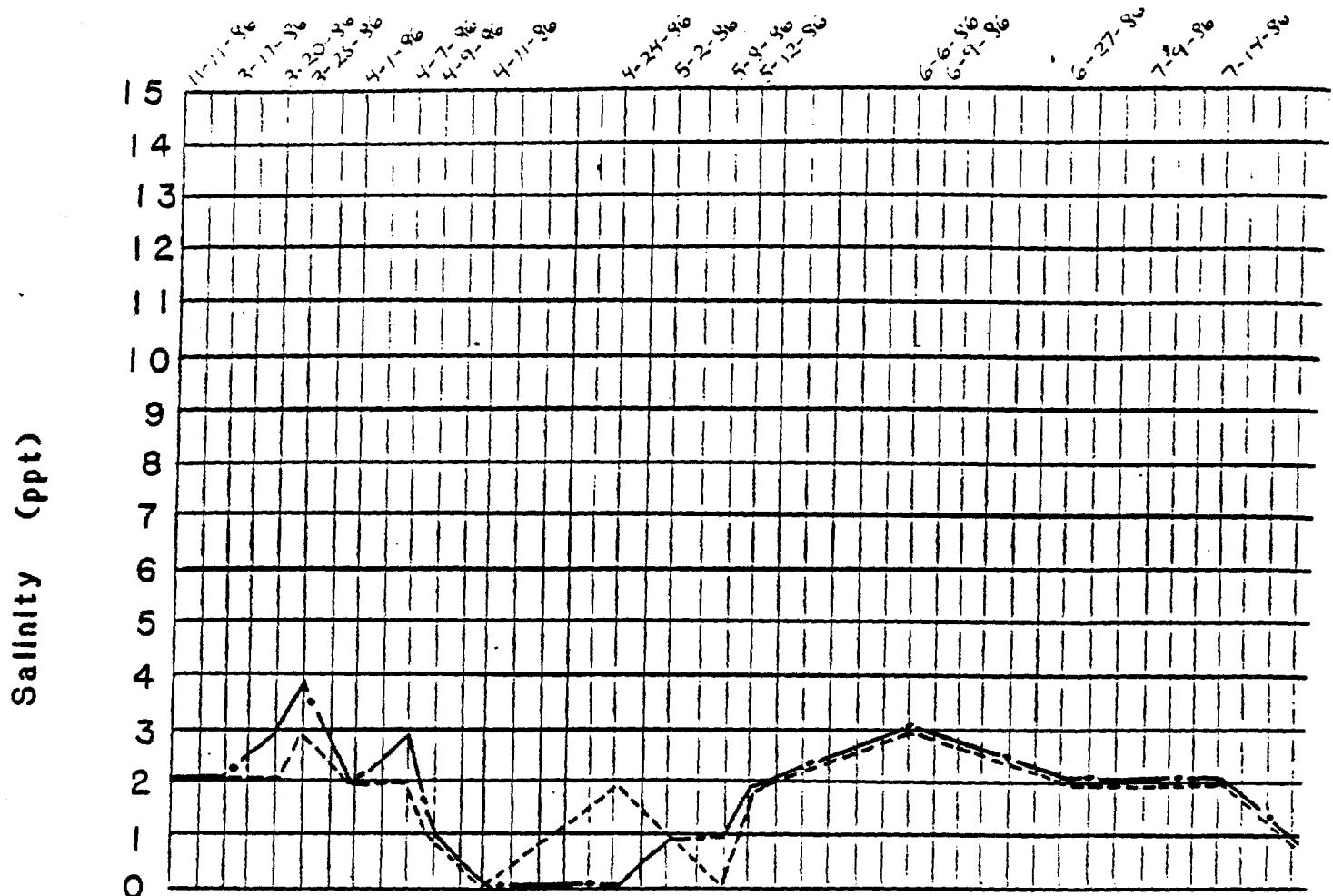


Average salinity inside of weir = 4.21 ppt

Average salinity outside of weir = 3.64 ppt

Salinity Readings

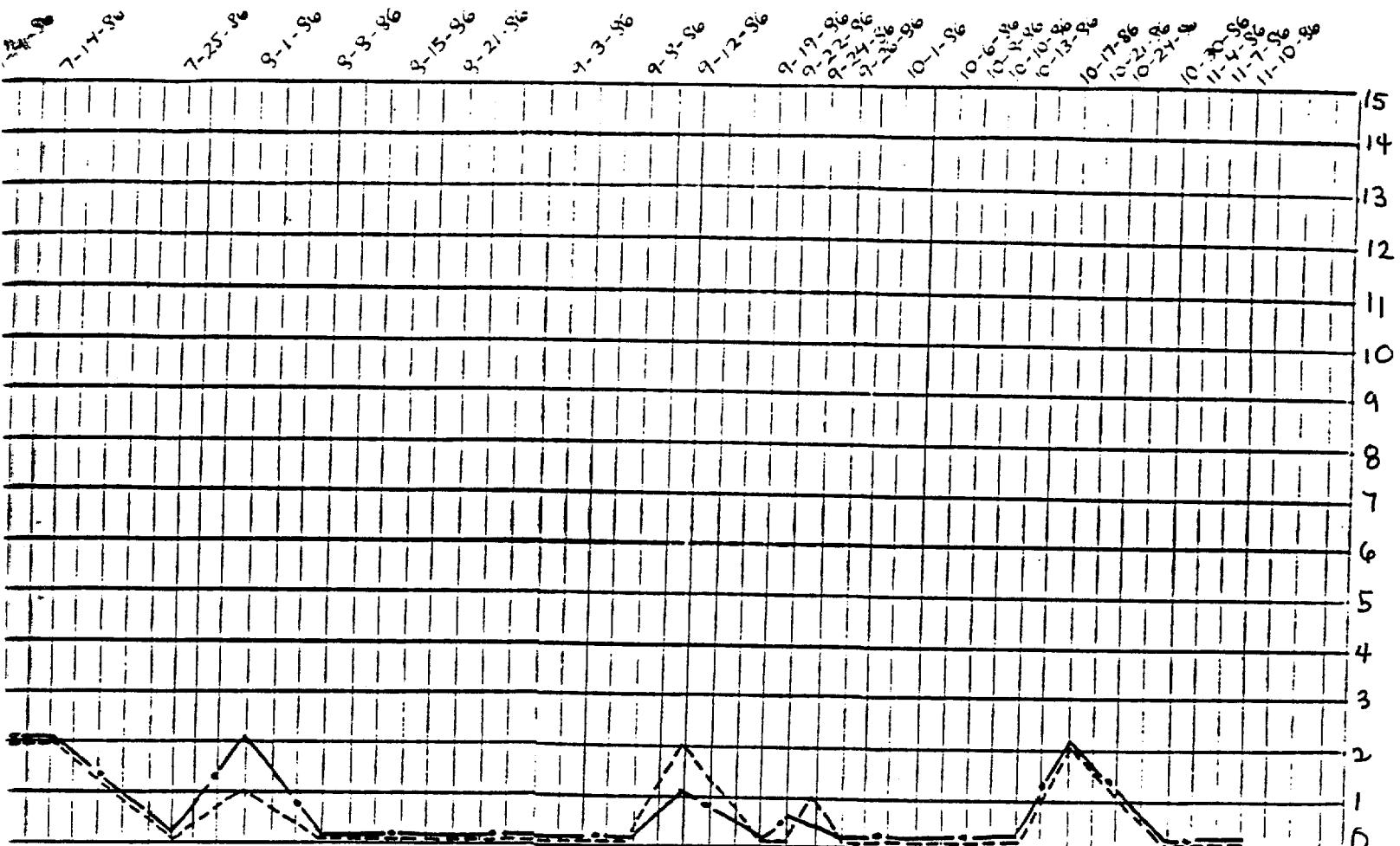
Figure 6



1/ Readings taken both Inside (— —) and Outside (---) of weir at Station 2.

Station 2 Weir 1/

Sampling Dates

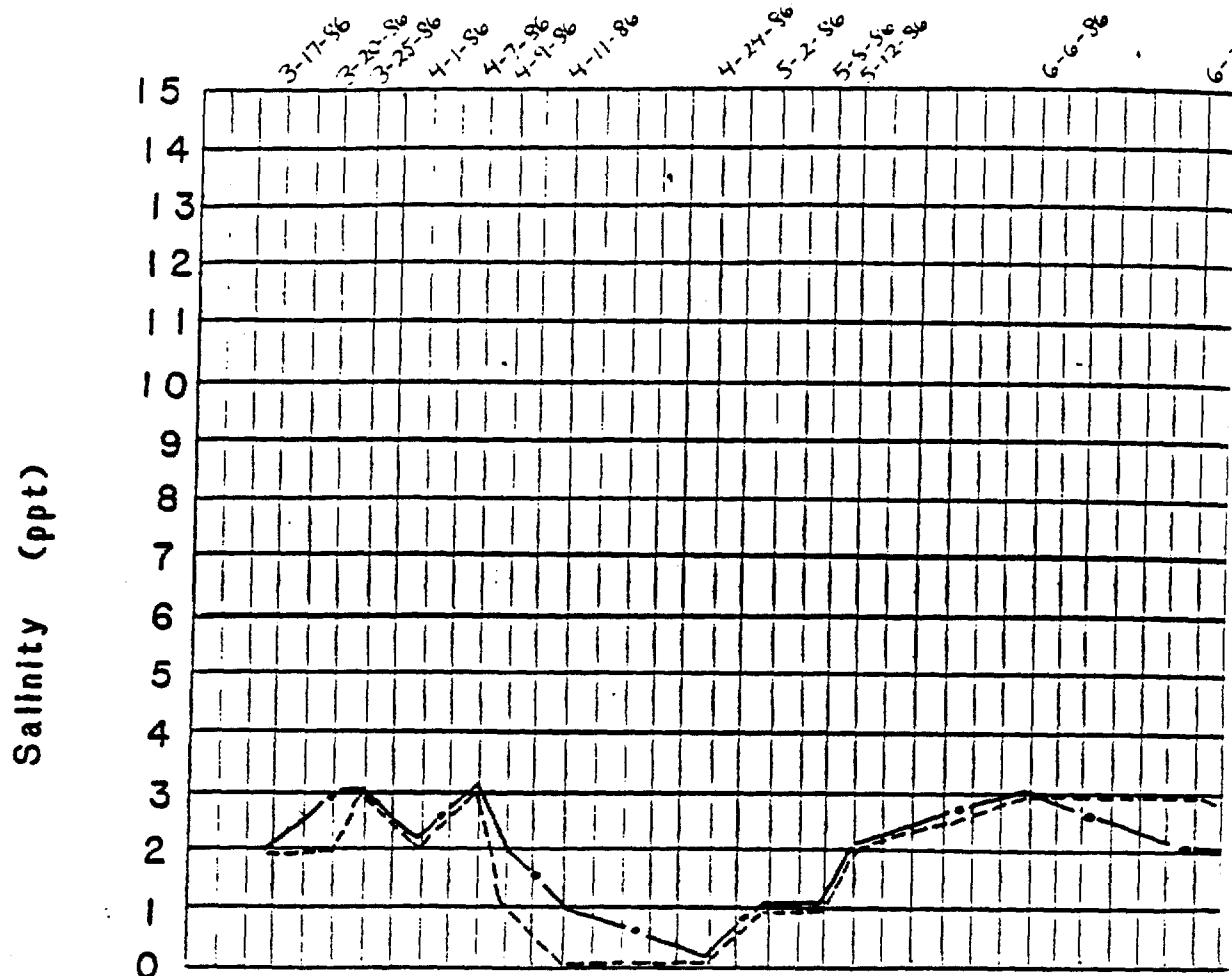


Average salinity inside of weir = .961 ppt.

Average salinity outside of weir = .825 ppt.

Salinity Readings

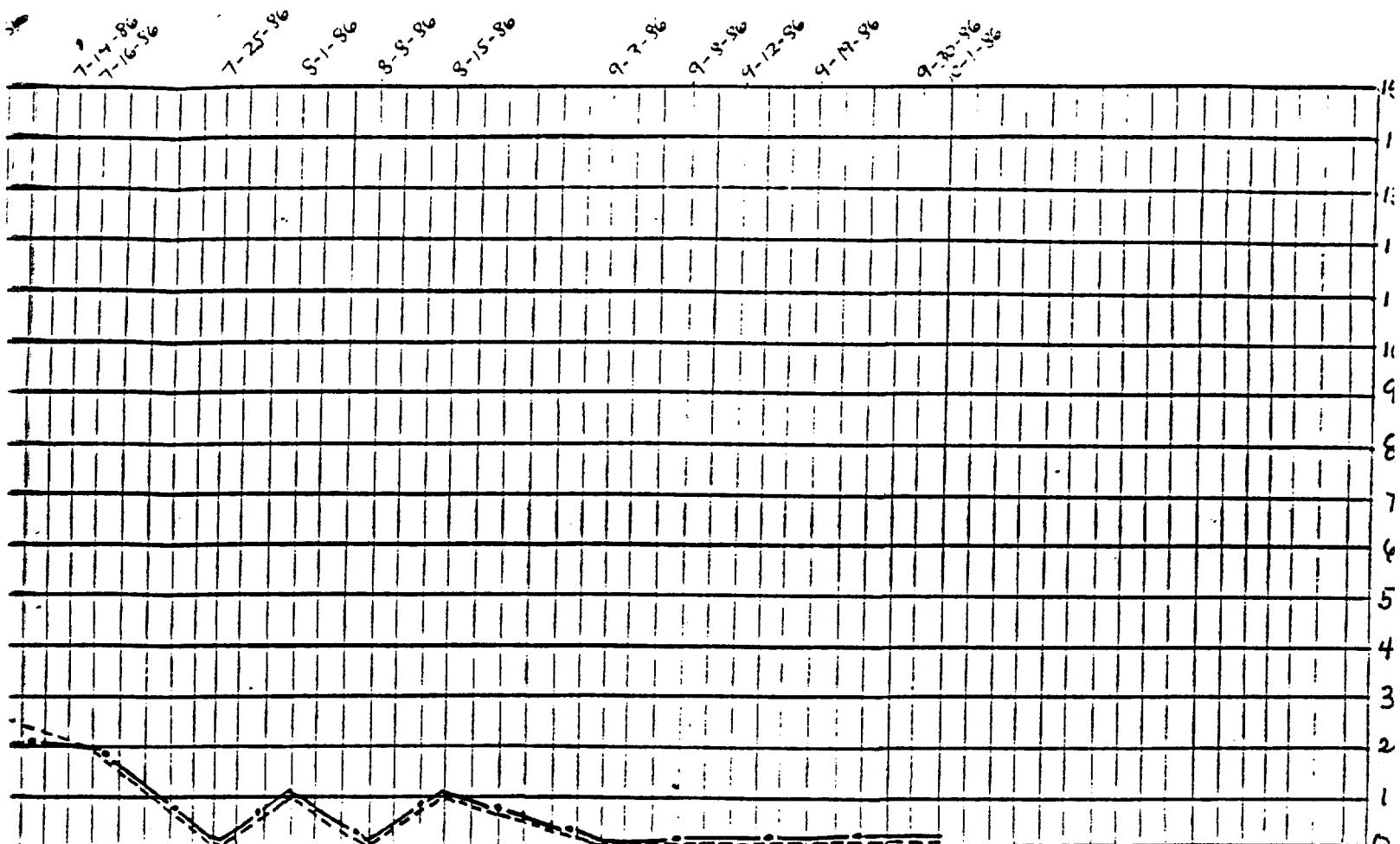
Figure 7



Station 3

Weir 1

Sampling Dates

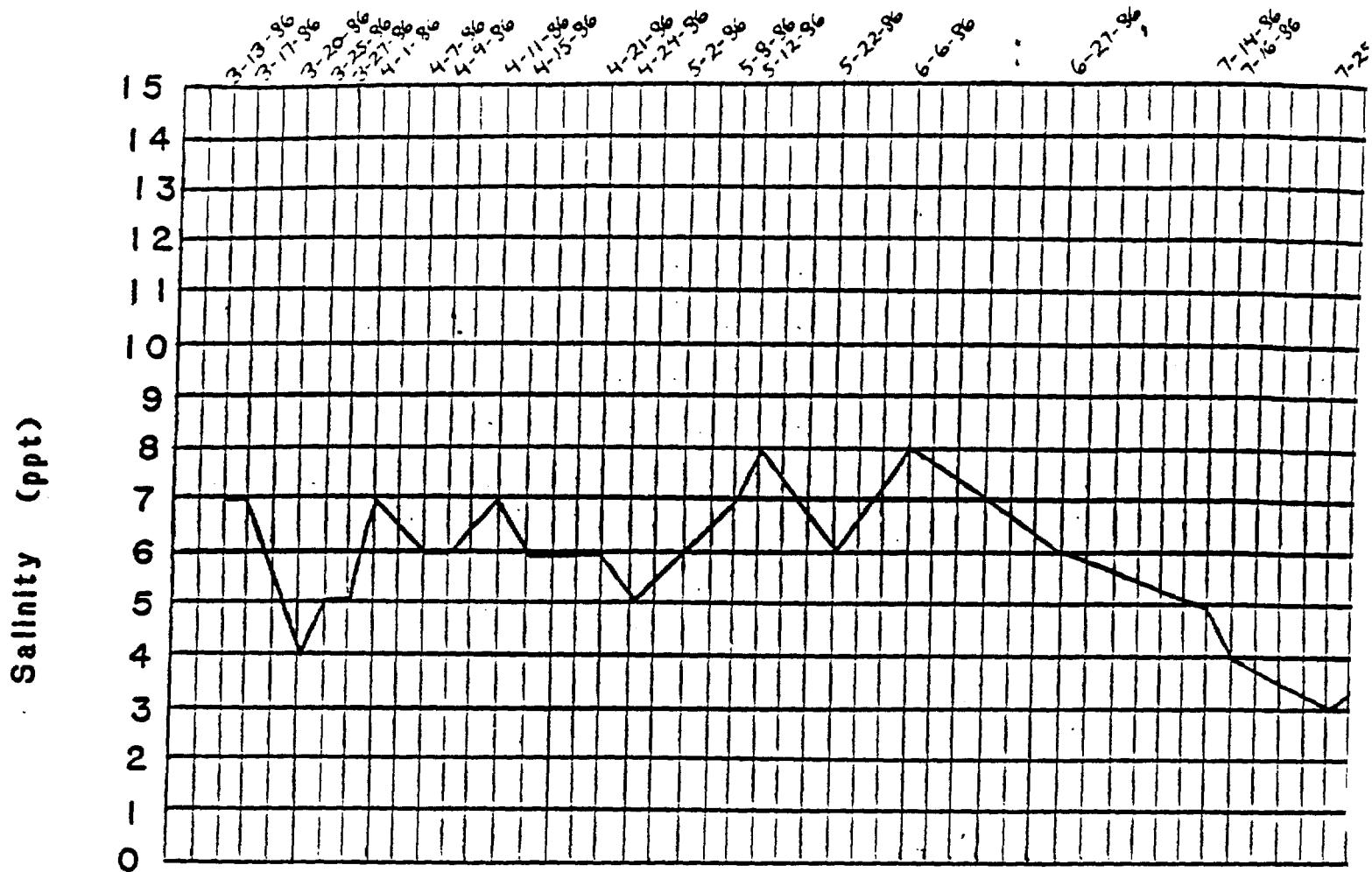


Average salinity inside of weir = 1.26 ppt

Average salinity outside of weir = 1.17 ppt

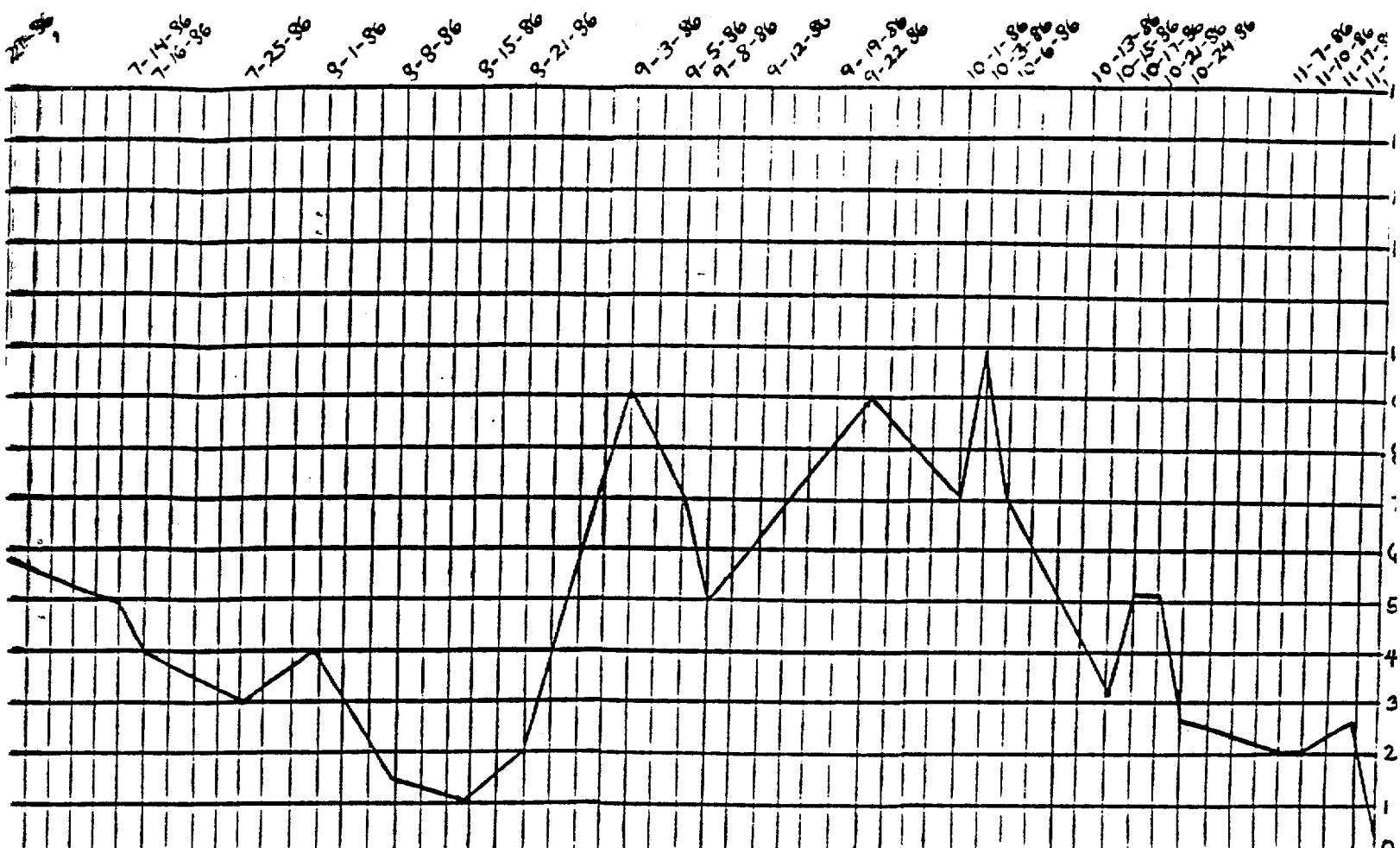
Salinity Readings

Figure 8



Station 4

Sampling Dates

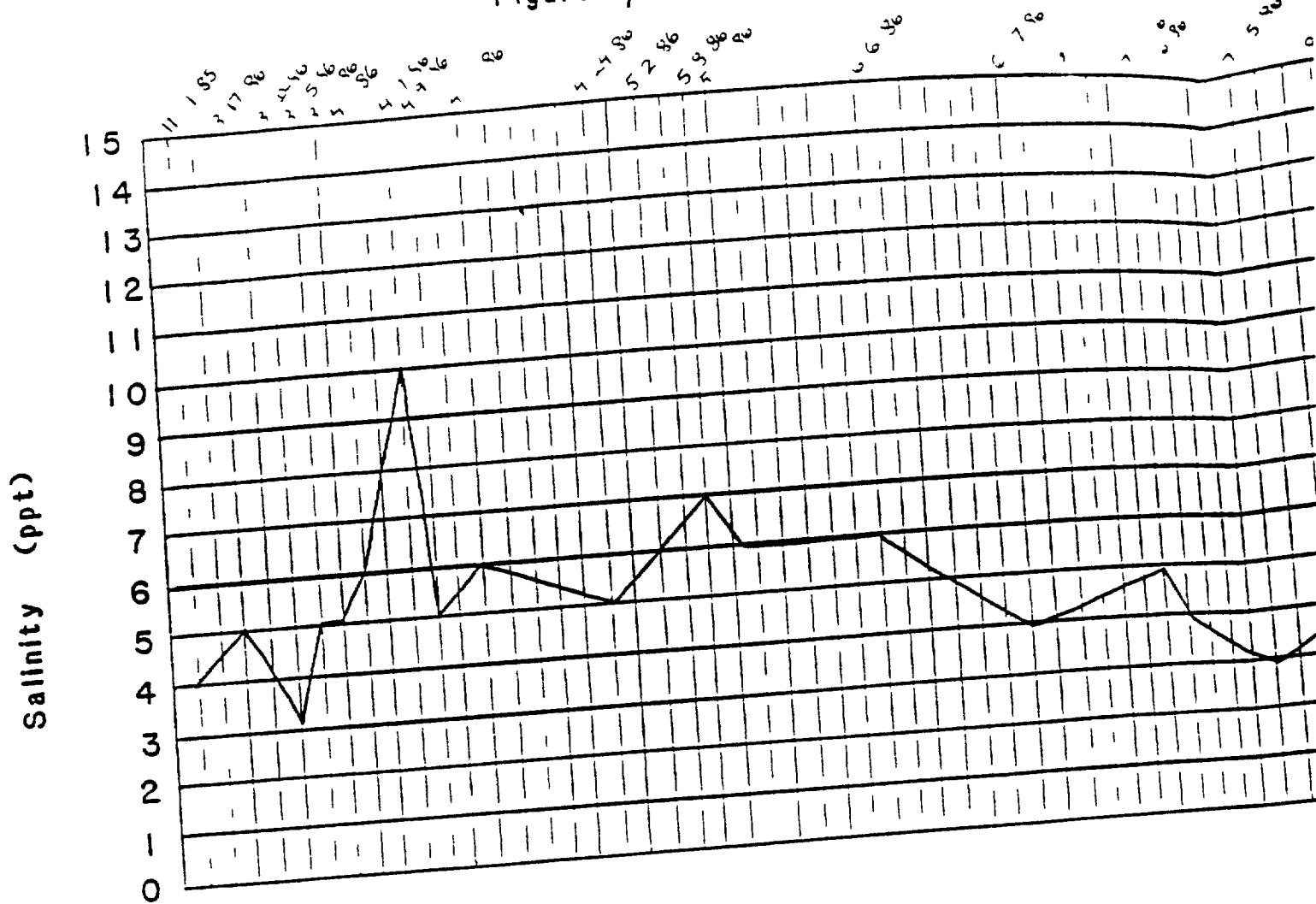


Average Salinity Reading - 5.26 ppt

Salinity Readings

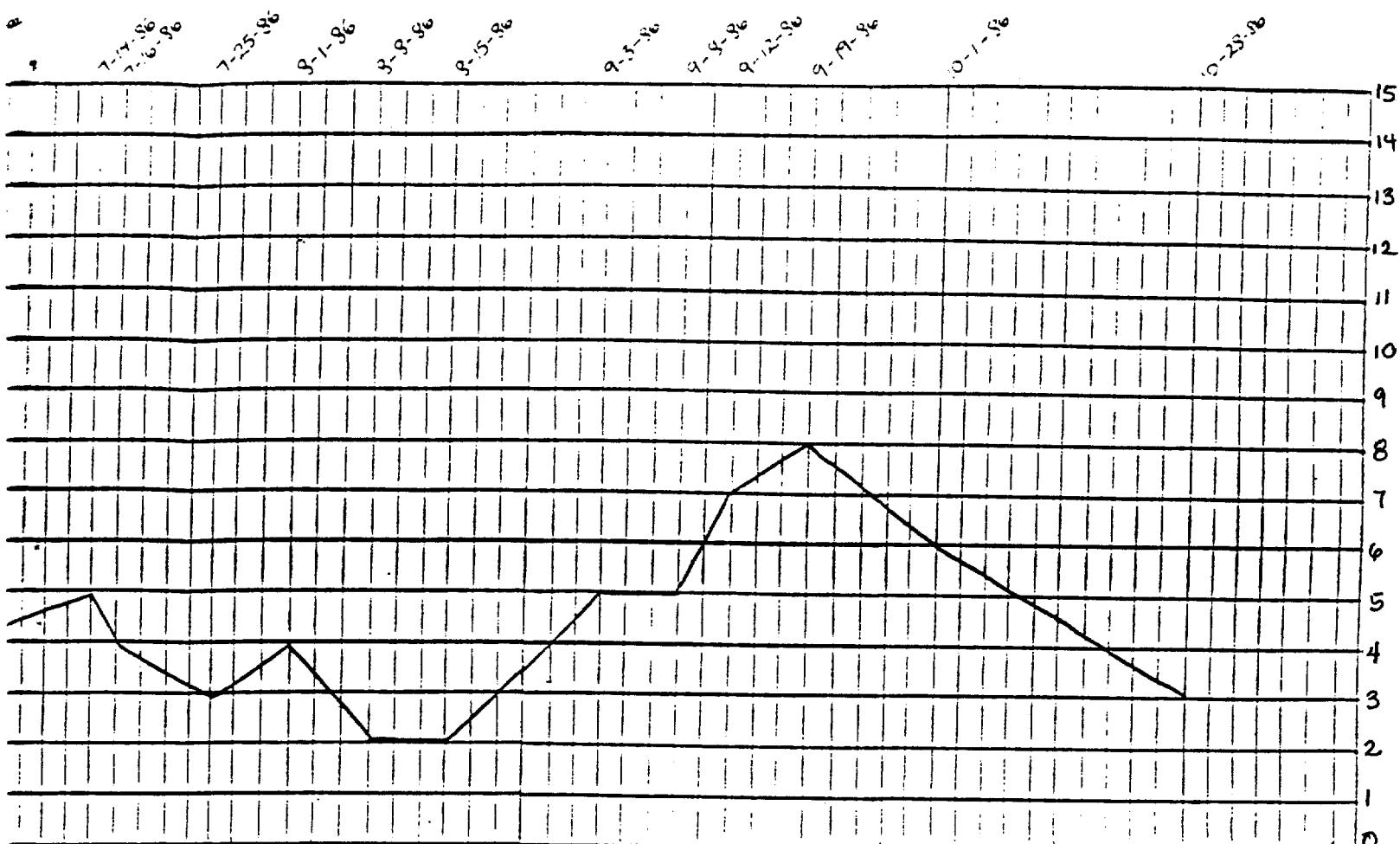
Sta¹

Figure 9



Station 5

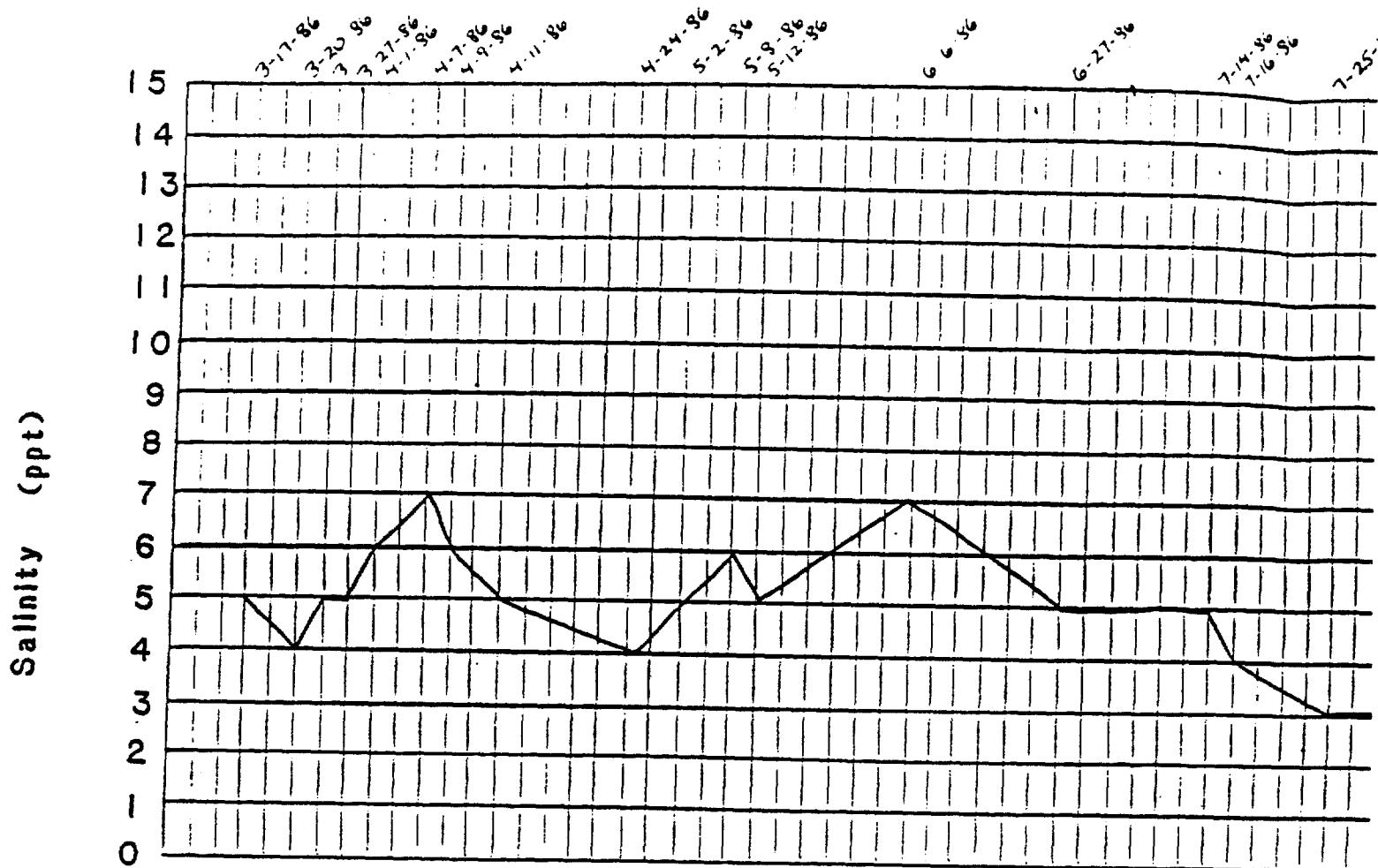
Sampling Dates



Average Salinity Reading - 5.07 ppt.

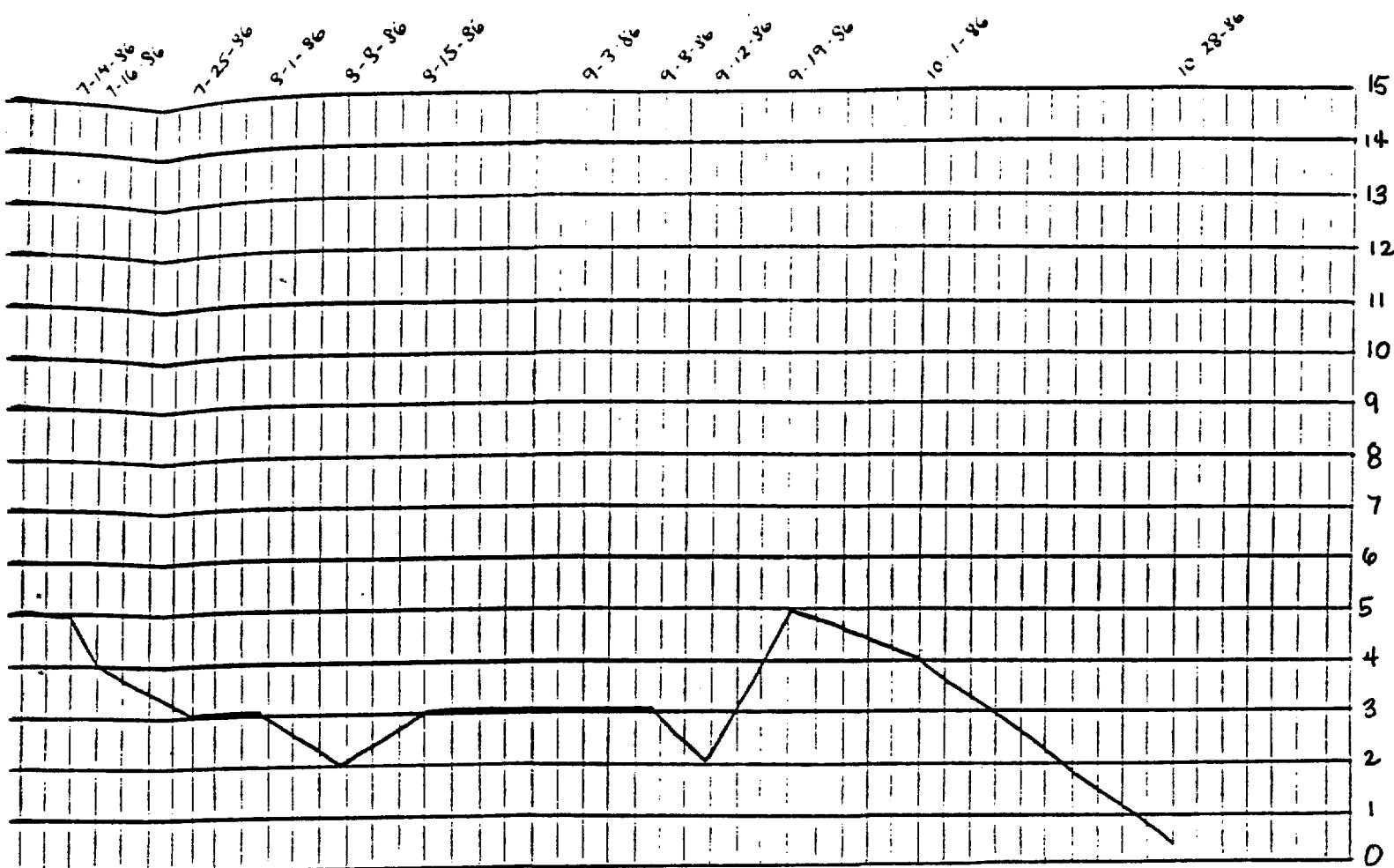
Salinity Readings

Figure 10



Station 6

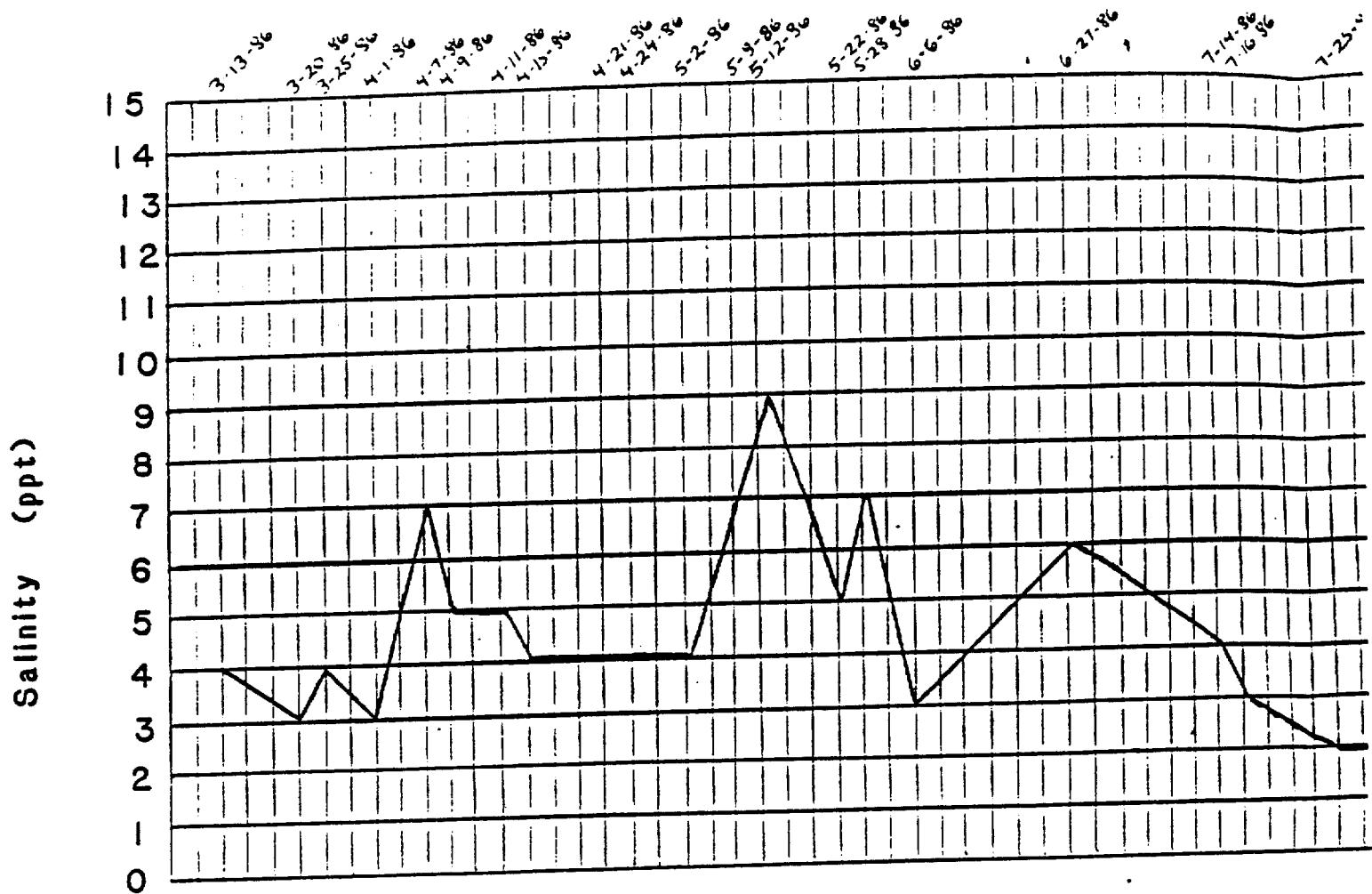
Sampling Dates



Average Salinity Reading - 4.32 ppt

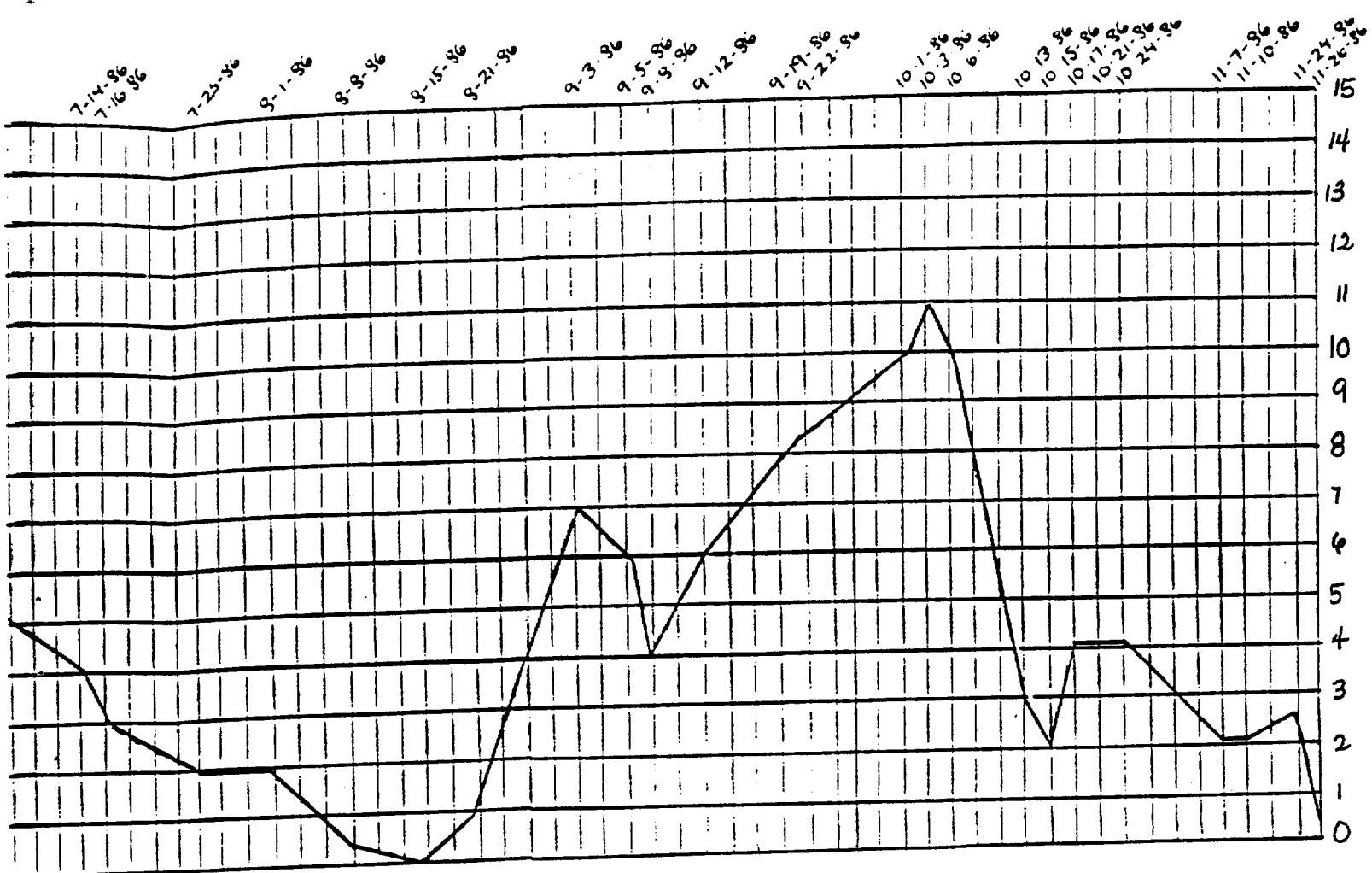
Salinity Readings

Figure 11



Station 7

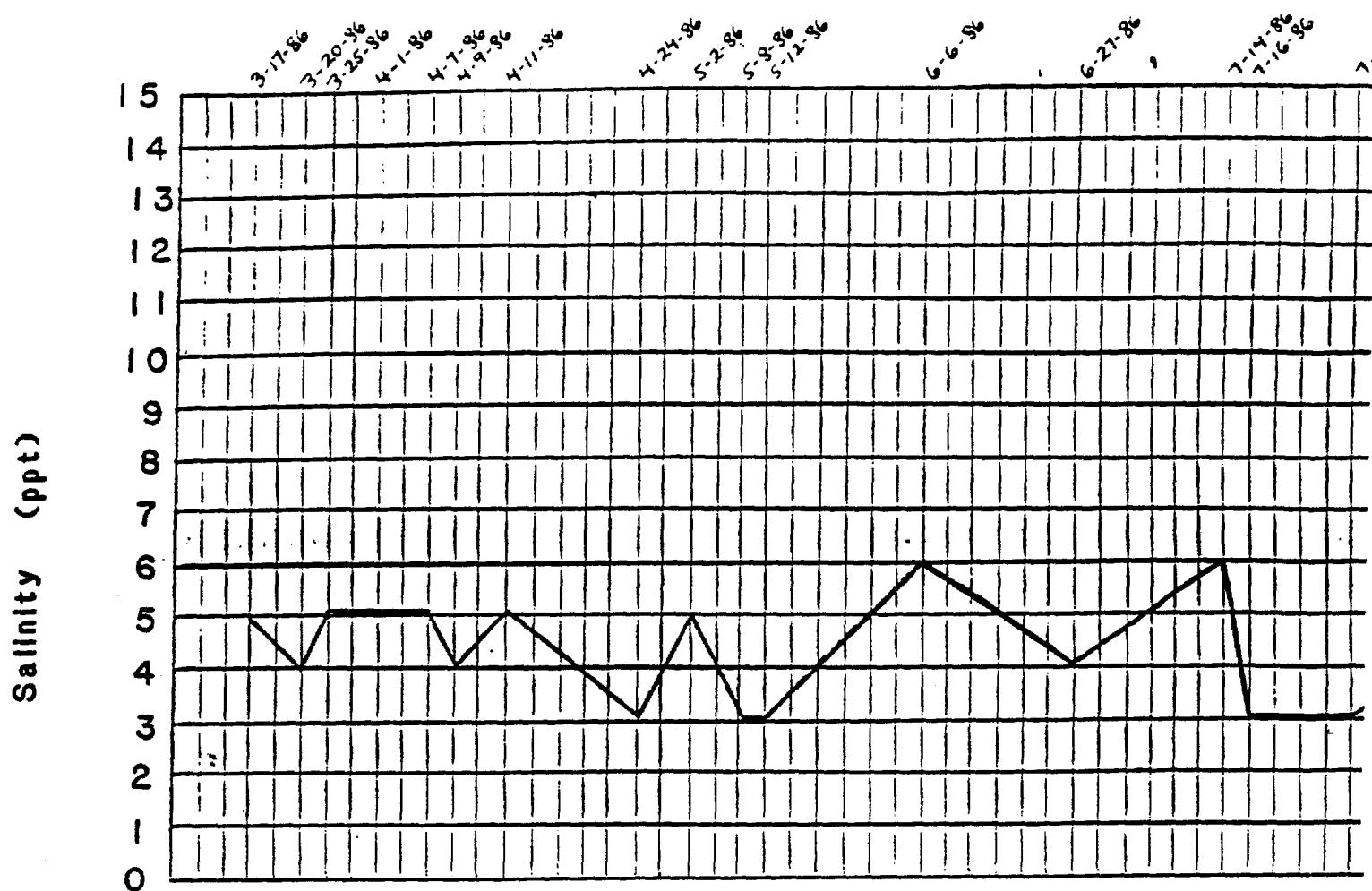
Sampling Dates



Average Salinity Reading - 4.66 ppt

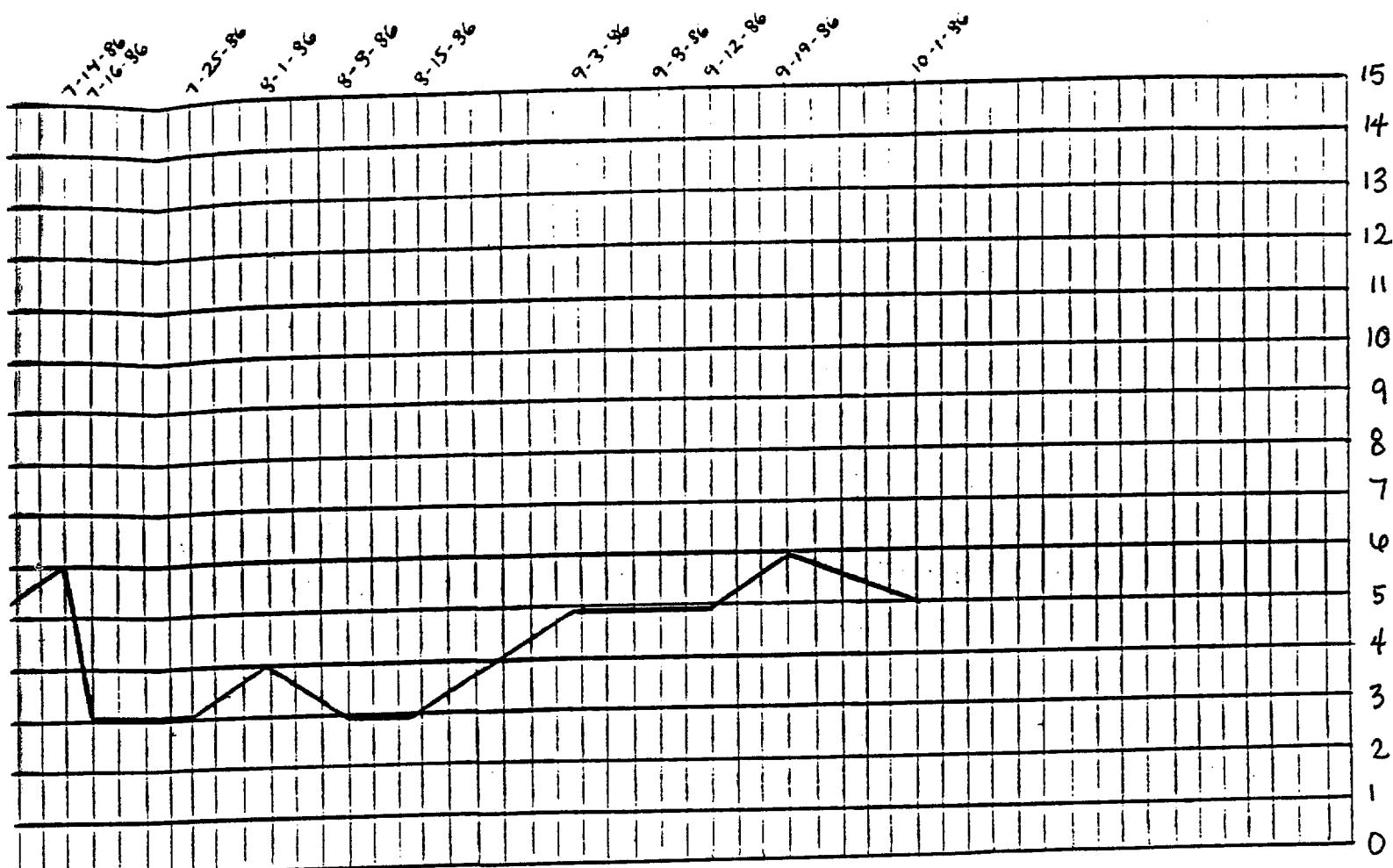
Salinity Readings

Figure 12



Station 8

Sampling Dates

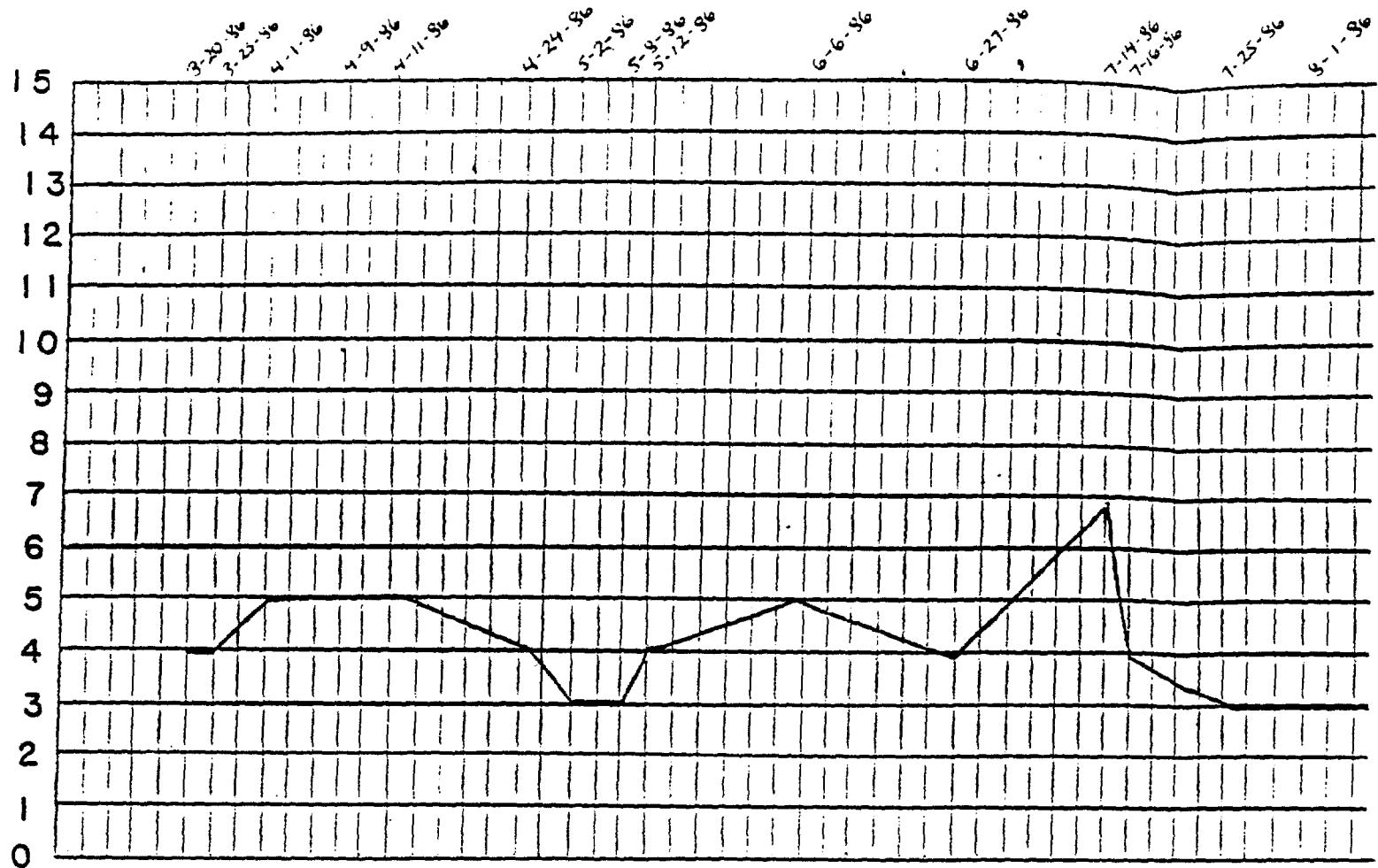


Average Salinity Reading - 4.37 ppt

Figure 13

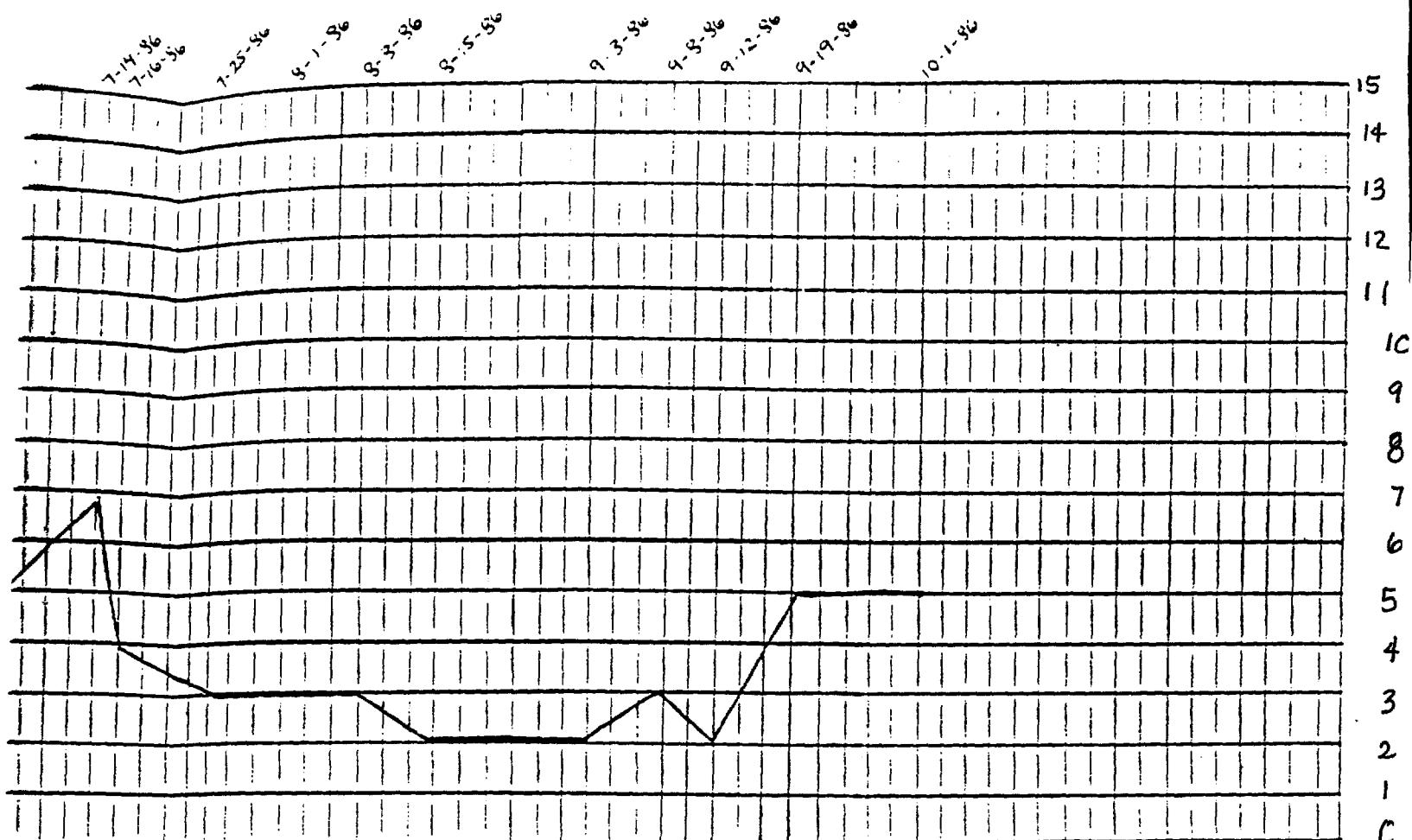
Salinity Readings

Station



Station 9

Sampling Dates

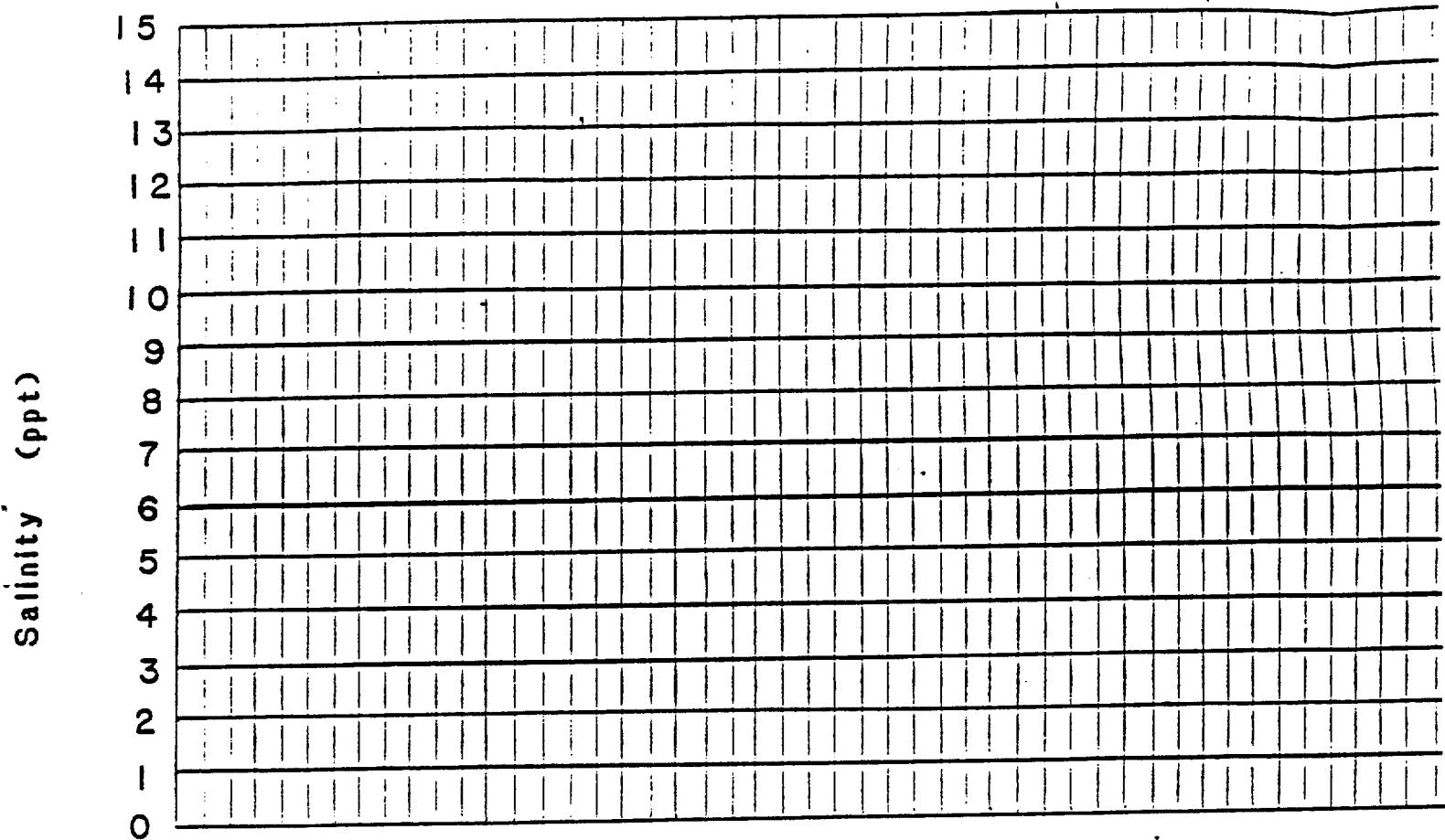


Average Salinity Reading - 3.86 ppt

Salinity Readings

St

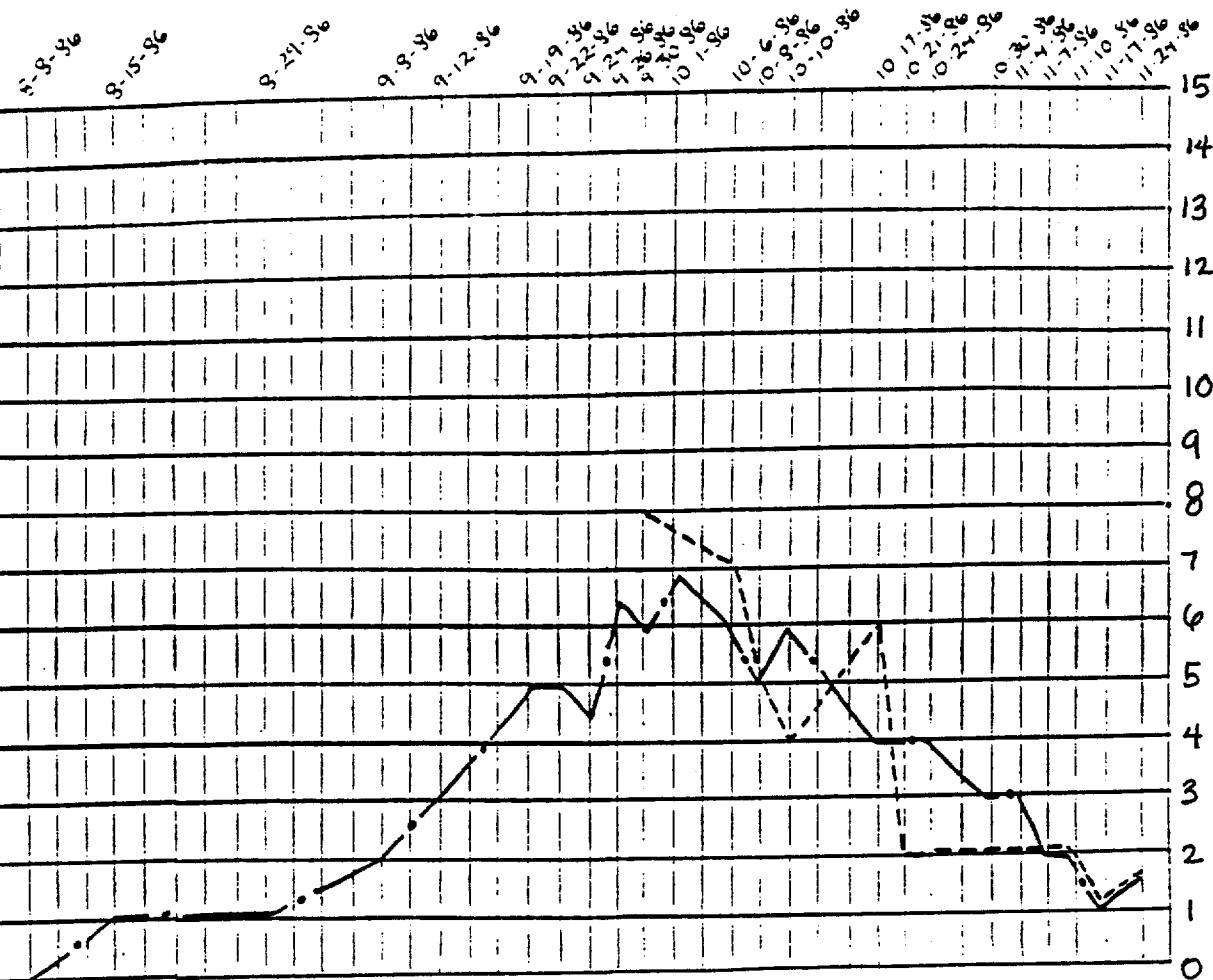
Figure 14



1/ Readings taken inside of management area (— - —) and outside of area in canal (-----)

Station 10 1/

Sampling Dates



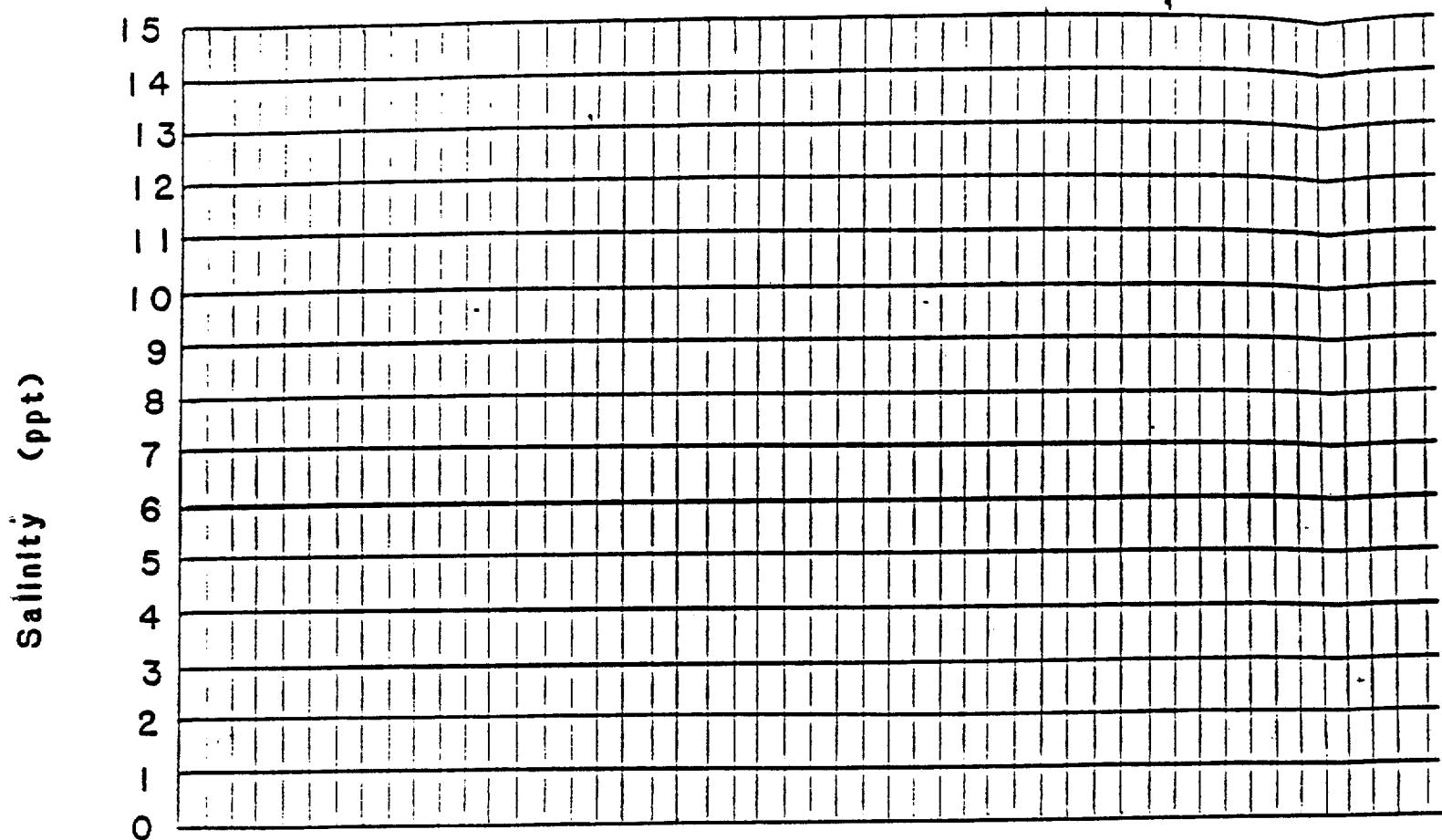
Average salinity reading inside management area = 3.58 ppt

Average salinity reading outside management area = 3.85 ppt

Salinity Readings

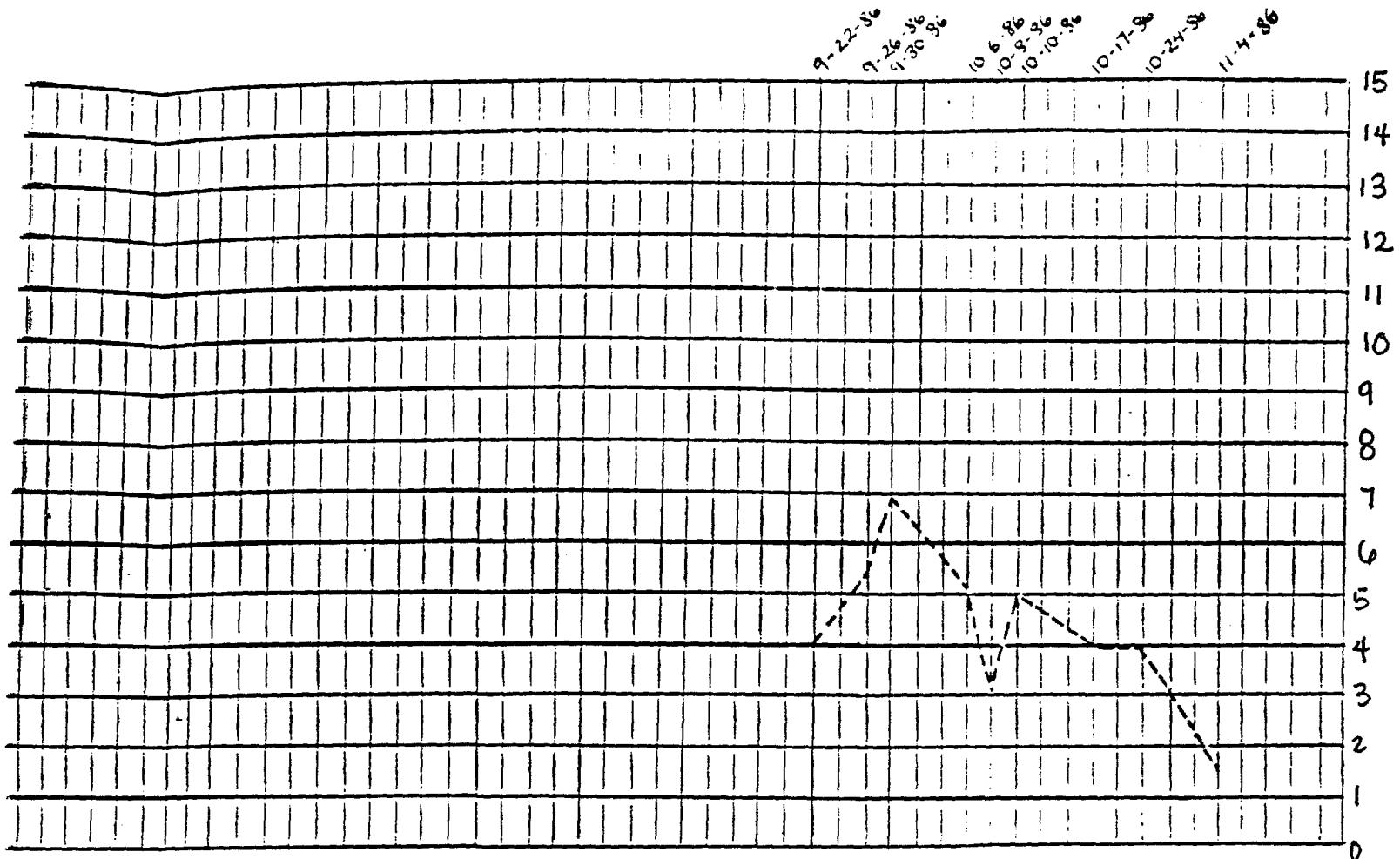
St

Figure 15



Station 11

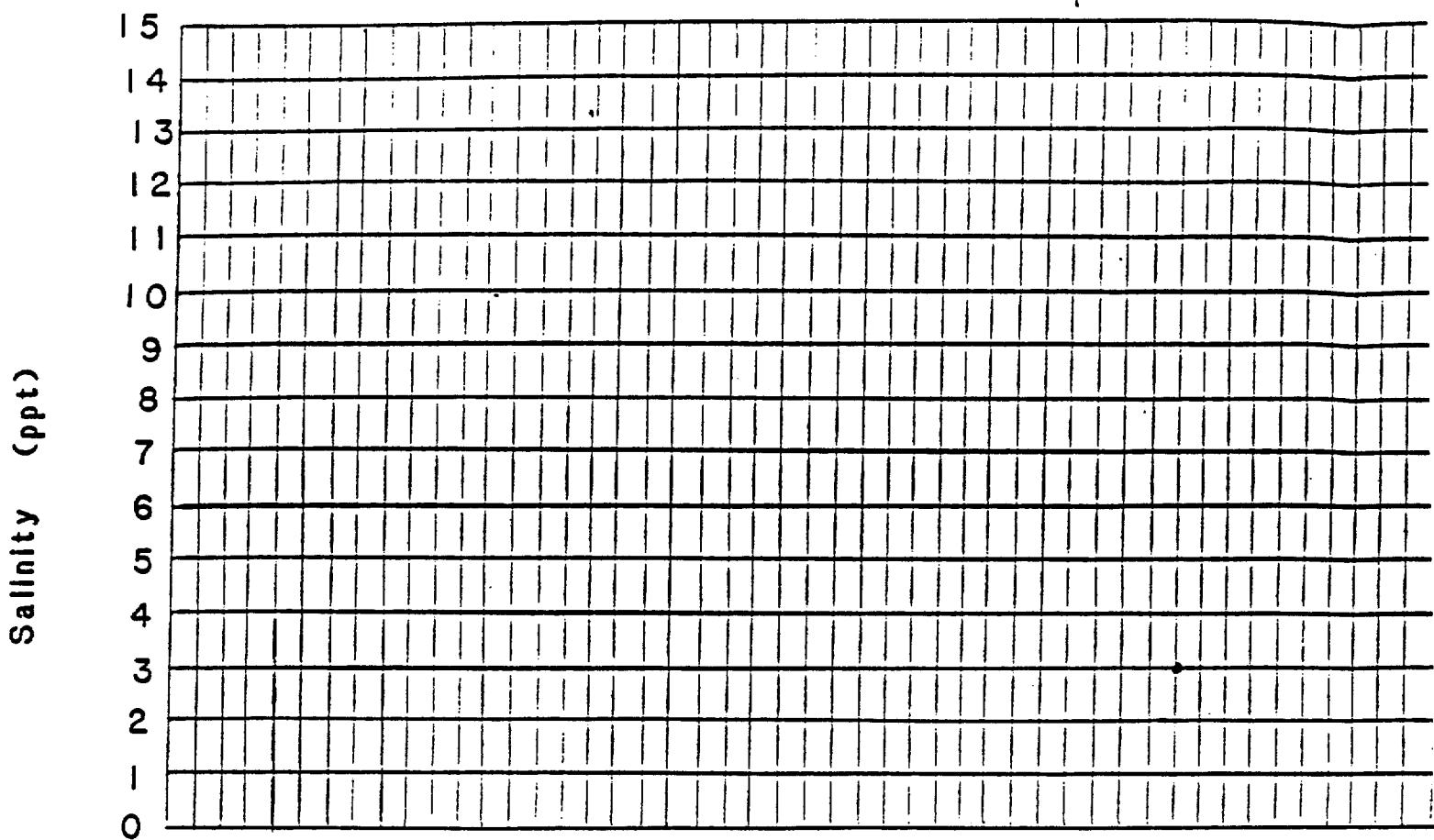
Sampling Dates



Average Salinity Reading - 4.4 ppt.

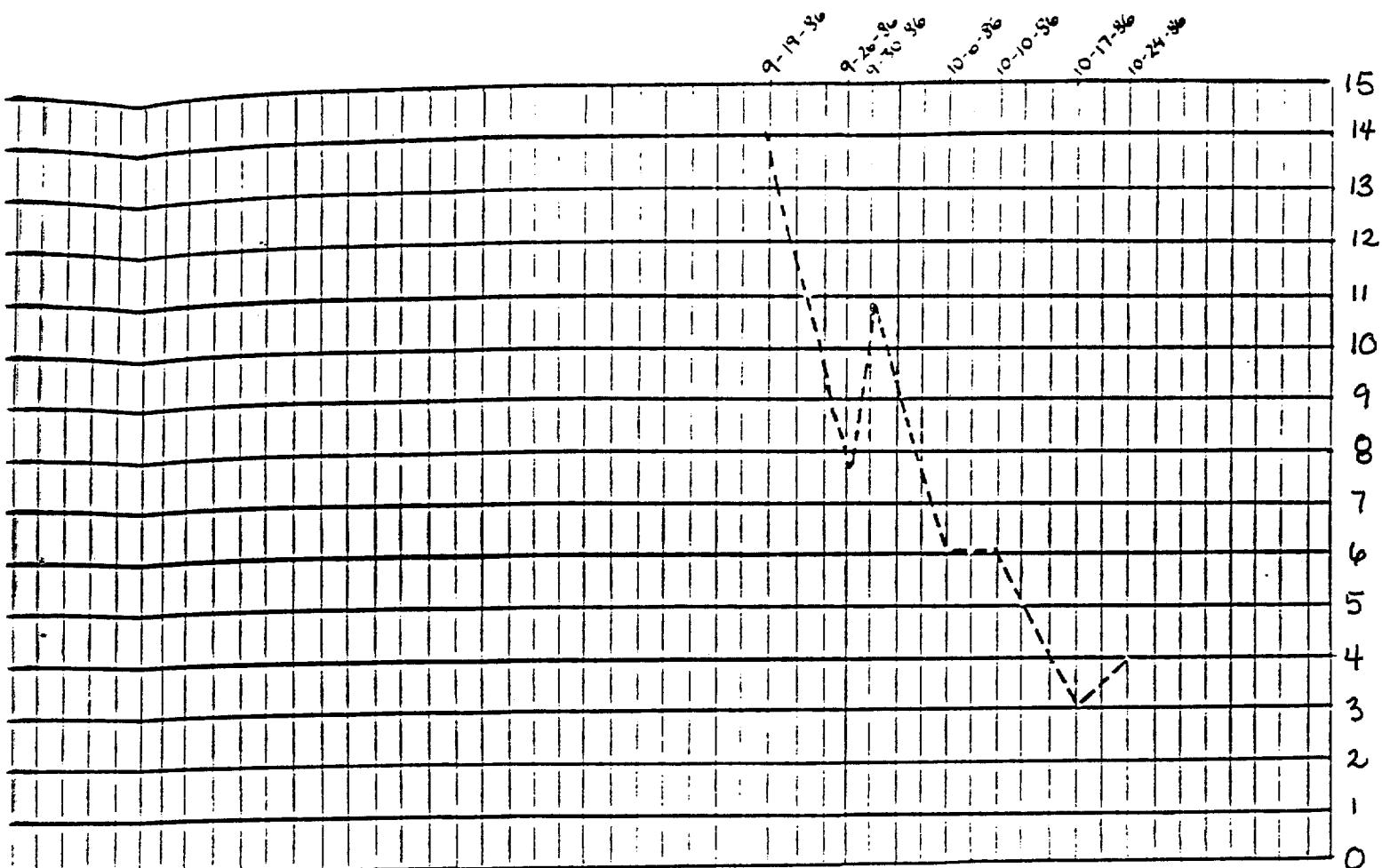
Salinity Readings

Figure 16



Station 12

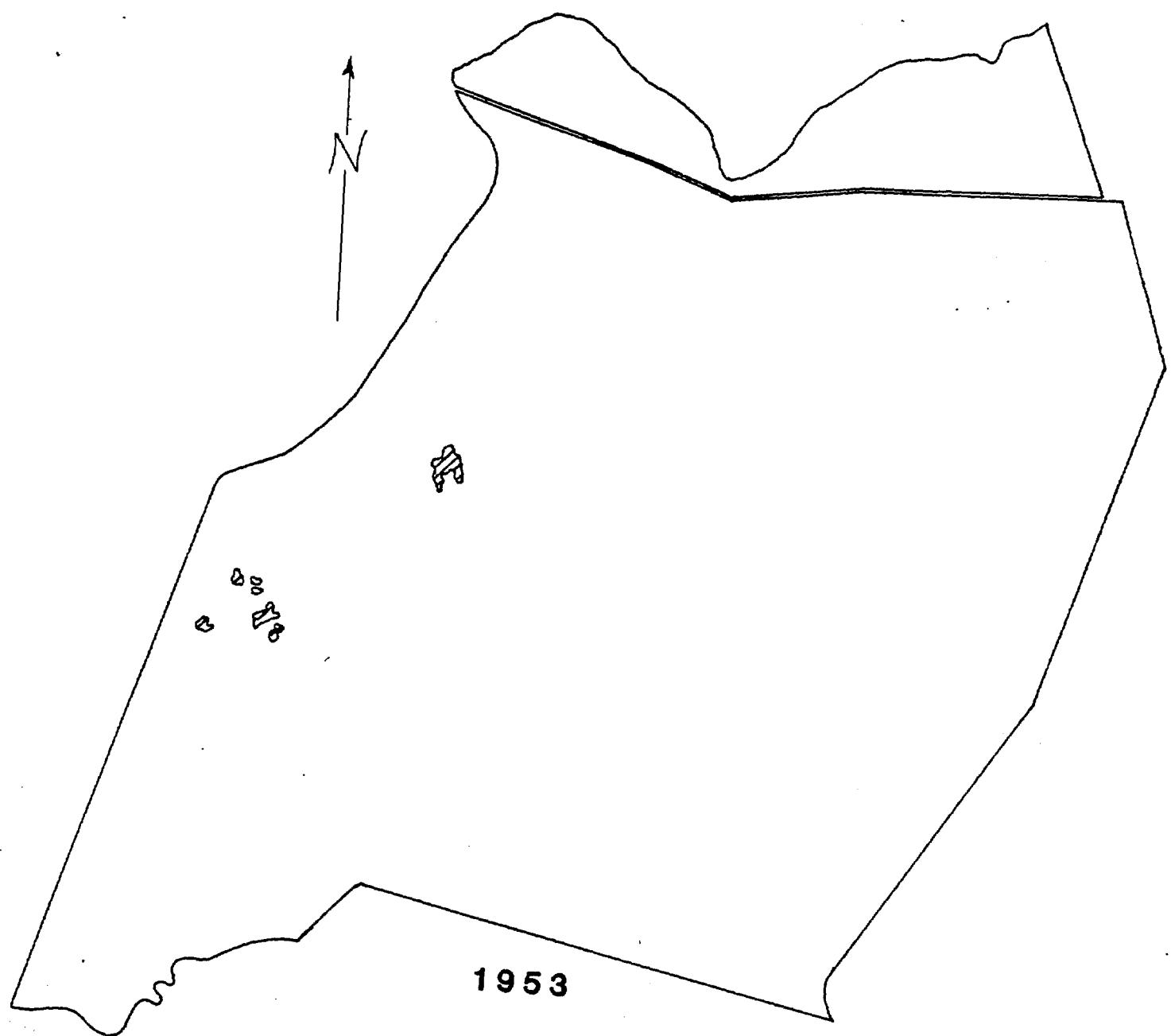
Sampling Dates



Average Salinity Reading - 6.81 ppt

Figure 17

Marsh to Water Ratio

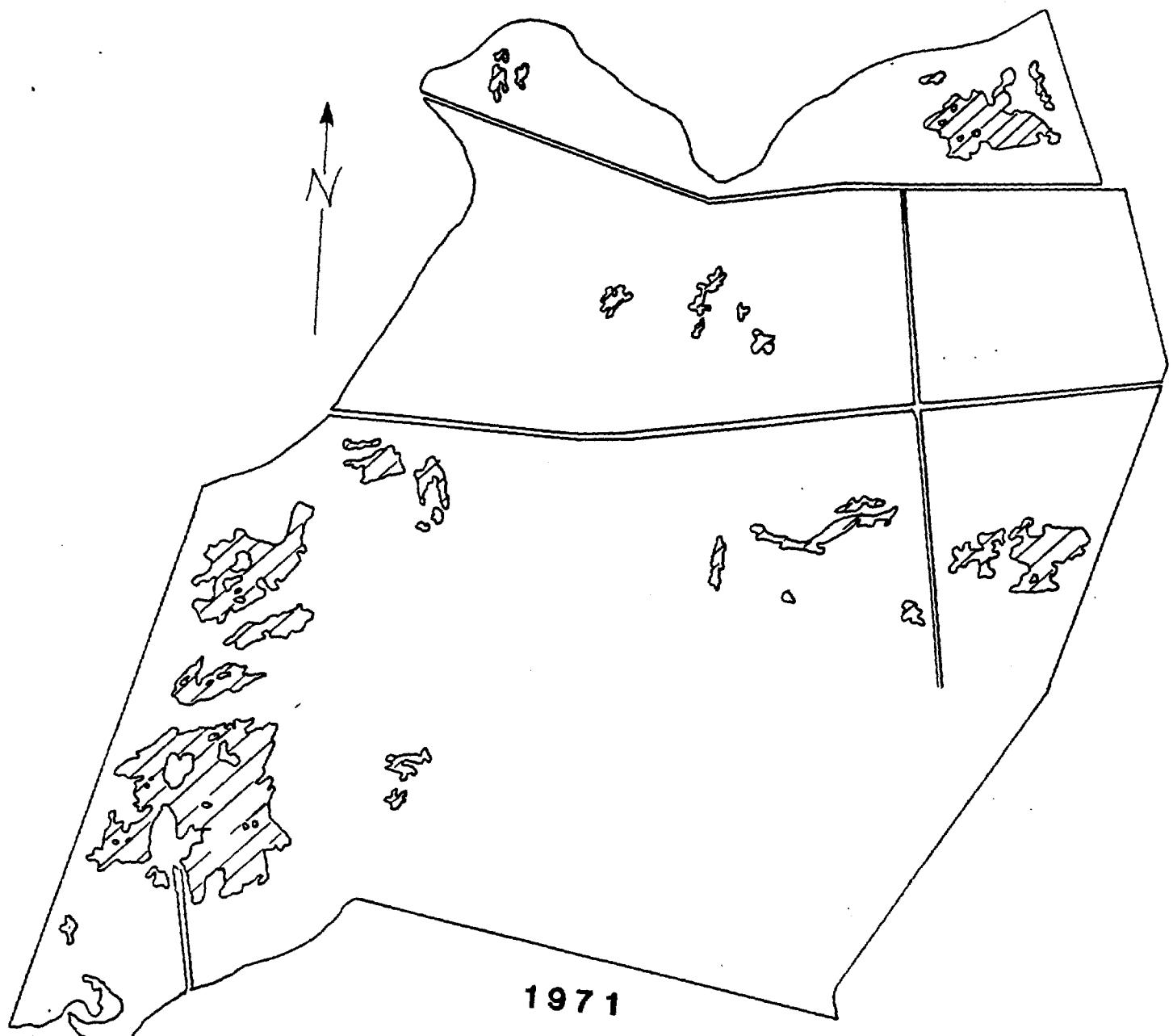


1953

Marsh 6999 acres

Water 15 acres

Figure 18
Marsh to Water Ratio



Marsh 5729 acres

Water 1285 acres

Figure 19

Marsh to Water Ratio

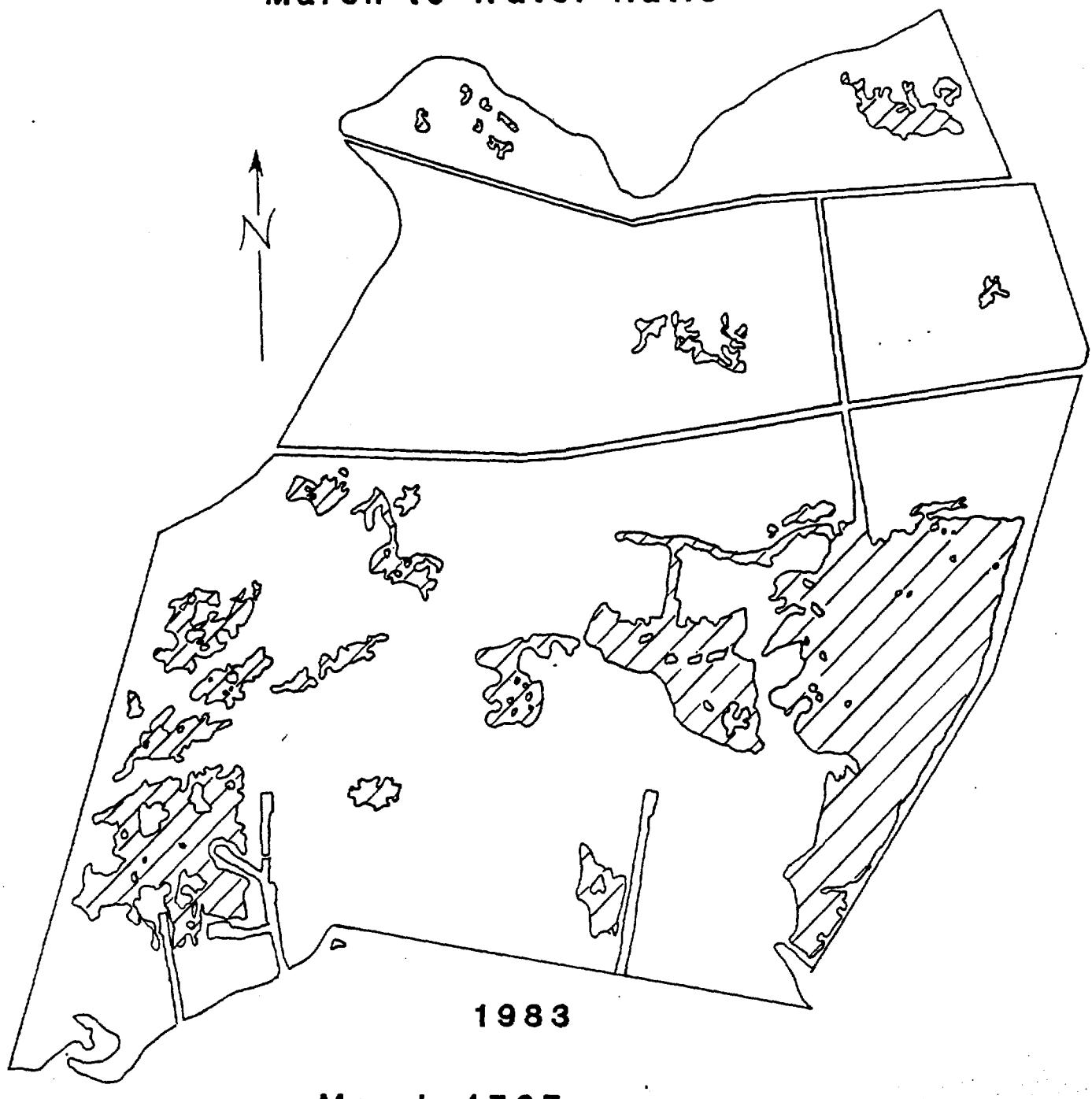
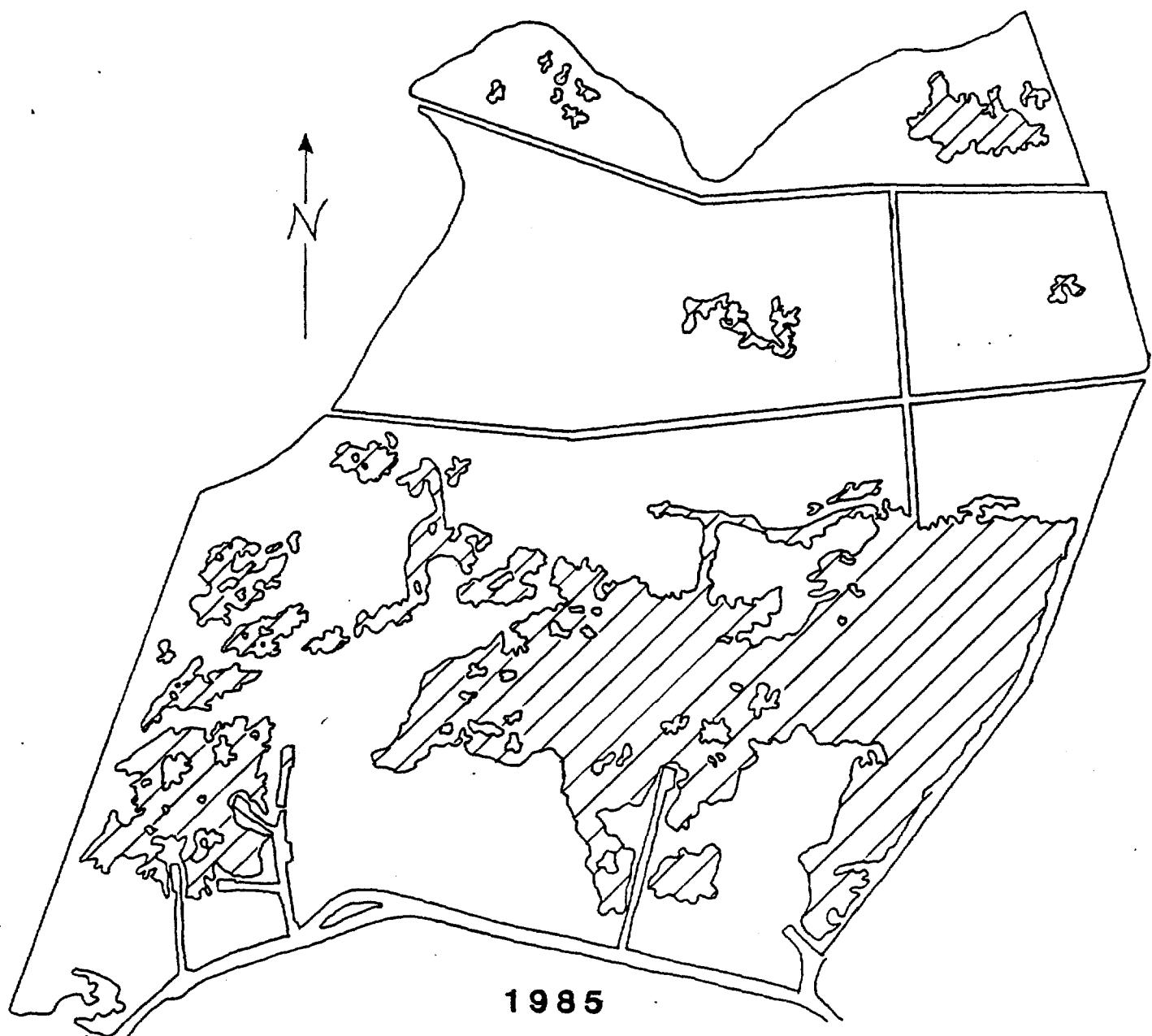


Figure 20
Marsh to Water Ratio



Marsh 4269 acres

Water 2745 acres

Figure 21

1982 - Fresh , Intermediate
and Brackish Marsh / Open Water

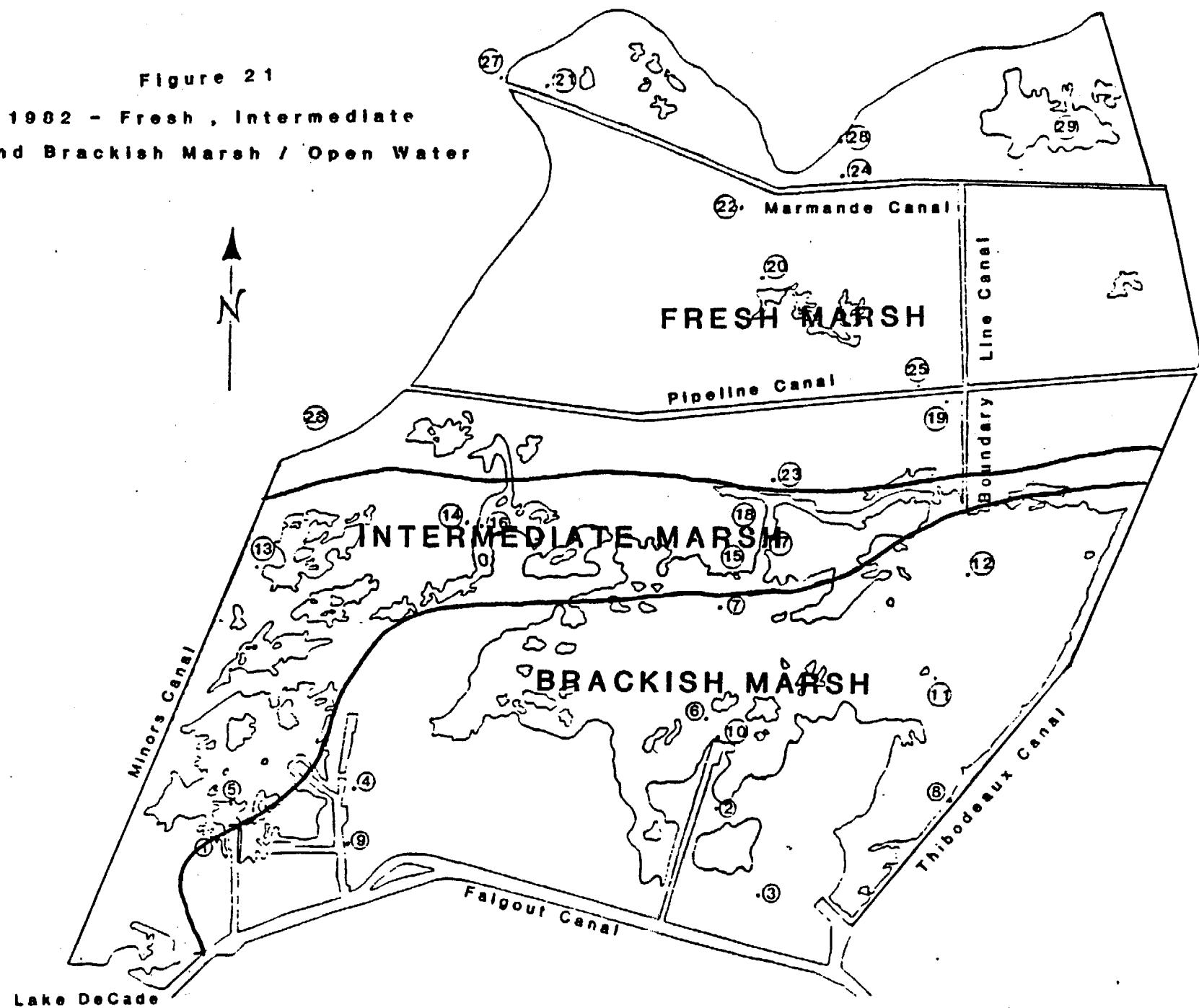


Figure 22

1986 - Fresh , Intermediate
and Brackish Marsh / Open Water

